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Organisation of Industrial Research

DURING the last week there have been two notable pronouncements from the public platform, both of which have a close bearing on the question of India's industrial future. Sir Mirza M. Ismail, Dewan of Mysore, in welcoming the delegates to the eleventh session of the *All-India Industries' Conference*, which met at Mysore on the 15th of this month, referred to the "fitful" and "fragmentary" character of our attempts to deal with the problem: "There has been no sustained and continuous visualisation of India's economic life in its several aspects into a self-consistent whole. Proposals like those of the Indian Economy Enquiry Committee for a comprehensive statistical organisation and of Sir Arthur Salter for an Economic General Staff, have

been allowed to disappear into oblivion. On the other hand, specific fields have been surveyed with thoroughness by various Committees and Commissions, i.e., Industries, Currency and Banking, Railways, Agriculture, but no effort has been made to examine the implications of the results of the surveys in their general economic setting."

In his welcome address to the fifteenth annual session of the *Inter-University Board*, which took place at Waltair on the same day, Dr. C. R. Reddi, Vice-Chancellor, Andhra University, spoke on the place of Universities in the war economies of a nation. He referred to the situation which arose 25 years ago and pointed out how the European countries and America grasped

the opportunity to achieve a state of self-sufficiency. "By confiscating enemy patents, by vigorously promoting domestic industries in regard to dyes, drugs, etc., and utilising Universities for purposes of the necessary researches, European countries and America became self-sufficing." The results of their efforts, can be judged by their present economic position, which is both permanent and enduring.

During the Great War, the Government of India appointed the Indian Industrial Commission, "to examine and report upon the possibilities of further industrial development in India and to submit its recommendations". The Indian Munitions Board which was the immediate outcome of its labours was constituted in January, 1917; some efforts to develop the national resources were made, but soon after the termination of the hostilities, little was heard of the Munitions Board, which might well have been constituted into a permanent body for promoting the development of industries in this country, as envisaged by the Commission.

Since the last War, a few institutions for the development of primary industries have been established in this country, thanks to the expanding activities of the Imperial Council of Agricultural Research; the Lac Research Institute at Ranchi; the Indian Central Cotton Committee at Bombay and the Indian Central Jute Committee at Calcutta, are typical instances. But these at the moment have done little for the establishment and stabilisation of the consuming industries in this country. The researches on the utilisation of lac, are being pursued more actively at the London Shellac Research Bureau at the consumers' door than in

India. In other words, these institutions have yet to play their part in helping the promotion of industries in India itself.

The Universities in India have fairly well-equipped laboratories and workshops; there are institutions like the Indian Institute of Science which provide facilities for industrial research; while a number of well-trained and competent men to tackle industrial problems, are available. What is needed, however, is a mechanism by which all the resources could be brought together under one directive authority for advancing industrial research.

The Indian Industrial Commission (1916) drew attention to the deplorable lack of organisation in the scientific services. They found that scientific experts formed themselves into heterogeneous groups with no uniform conditions of service, no definitely established policies or precise limits of their activities. They also discovered a complete absence of effort to secure collaboration in scientific research. This disorganisation had involved a considerable waste of money, time and talent, by duplication of equipment and effort. Even to-day, the conditions are not different. There is considerable overlapping of research work on some subjects and total neglect of others. There is no authoritative organisation for assessing the value of results on any particular investigation and a disconcerting variety of isolated and short-lived serial publications frequently make their appearance.

It is, perhaps, pertinent to recall that early in 1915 the British Government, in spite of the pre-occupations and distractions of a terrible war constituted the Department of Scientific and Industrial Research in order to ensure a systematic application of research

for organising her economic resources. Later, special research organisations, controlled and financed by this Department, were inaugurated to deal with the scientific aspects of the use of fuel, the storage and transport of food, buildings and roads—subjects of great importance to the common welfare of the community. The industries began to appreciate the importance of scientific research for their advancement and prosperity and it became possible for the Government to institute a number of co-operative research associations, autonomous and controlled by representatives of the industries concerned and financed by the funds of the Association supplemented by grants by the Department. The establishment of a Department of Scientific and Industrial Research in Great Britain, was soon followed by the institution of similar organisations in other parts of the Empire; Canada had its National Research Council in 1916, while Australia formed its Council of Scientific and Industrial Research in 1926. The United States of America founded its National Research Council in 1916, while Japan established its National Institution in 1919. India needs an organisation modelled on very much the same lines as the Department of Scientific and Industrial Research of Great Britain and the Government of India is the only authoritative body who should take the initiative in this matter.

Sir A. Ramaswami Mudaliar, Commerce Member to the Government of India, mentioned at the recent Industries Conference that the Government could give the commercial community an indication of the kind

of industries that might safely be developed during the war and of the nature of assistance they could extend to such industries. He also said that the Government would indicate beforehand, the nature of the aid which the industries may expect after the cessation of the war. Businessmen who launch upon new enterprises, taking advantage of the abnormal conditions created by the war, must be assured of some sort of protection after the termination of the conflict. An immediate declaration of such a policy by the Government at this stage would stimulate private enterprise in the field of Indian industry. The appointment of a committee to investigate the production of drugs and the proposal regarding the Government of India Statistics Act for allocating and collecting industrial statistics to enable the Government to have adequate information about industrial progress, were announced at the Conference. These announcements are reassuring and they will undoubtedly contribute to the development of industries in this country. What is even more vital to the industrial development of India is a national organisation for industrial and scientific research for developing the vast resources of this country. The labours of numerous committees in the past have resulted in the accumulation of valuable data regarding India's industrial potentialities and the time is opportune for establishing an organisation—a National Research Council—under the auspices of the Government of India for planning and directing Industrial Research on an all-India basis.

Prof. E. O. Lawrence

ERNEST ORLANDO LAWRENCE, who has won the signal distinction of a Nobel Prize for Physics for 1939, began his research career at the University of Chicago in the year 1924, under Professor Swann, on the photo-electric effect in potassium vapour as a function of the frequency of light. With Professor Swann, Lawrence moved to the University of Yale where he completed these investigations which formed the subject of a dissertation for his Ph.D. degree. In 1928 Lawrence migrated to the University of California at Berkeley and there he is now continuing his investigations which have brought him fame and the approbation of the scientific world. Much of Lawrence's earlier work was concerned with studies of photo-electric phenomena. It was in 1931 that Lawrence began to tackle the problem of production of high speed ions.¹ R. Wideroe had by then suggested an apparently simple method of producing high voltage ions using only relatively low applied voltages,² and had himself succeeded in obtaining 50,000^v potassium ions in a tube to which a maximum voltage of half that value had been applied. Lawrence took up the idea and improved upon it with perseverance and ingenuity.

The principle of the method of Wideroe as at first developed by Lawrence is as follows: A series of cylindrical electrodes arranged along the length of an evacuated tube are attached alternately to either terminal of the inductance of a high frequency oscillatory circuit. A high frequency voltage applied in this manner, produces at any instant, electric fields of opposite direction and equal magnitude between successive electrodes. If at any one instant an ion finds itself between the first and second tubes it will be accelerated into the second tube, and if the time consumed in passing through the field-free space inside this tube is equal to the half period of the oscillator, the ion will arrive between the second and third tubes, with the field reversed in direction in such a manner that it will receive an additional acceleration while passing into the third tube. If the tubes are made successively longer to take account of the increasing velocity of the ion, for every frequency of applied oscillations there will be a corresponding voltage applied such as will cause the ion to move up through the

series of tubes in synchronism with the oscillating field, gaining between each pair of tubes an increase in kinetic energy corresponding to the applied potential difference. Sloan and Lawrence³ showed that by the above method they could produce mercury ions of 1,260,000 volts using 30 accelerator brass tubes and a high frequency voltage of 42,000 on a wave-length of 30 meters.

The difficulty with the above type of apparatus is that the lengths of the accelerator tubes used towards the end of the path become very large even for heavy ions like Hg ion and the whole apparatus becomes inordinately long. To overcome this difficulty Lawrence conceived the idea of bending the path of the ions into circular orbits by a magnetic field and thus the first "cyclotron" was born.⁴ In this device the electrodes in the form of semicircular hollow brass plates are mounted with their diametral edges adjacent in a vacuum and in a uniform magnetic field perpendicular to the plane of the plates. An oscillating electric field is produced by high frequency oscillations applied to the electrodes in the diametral region where ions are accelerated. They then describe semi-circles inside the electrodes, the time taken being arranged to be a half period of the oscillations. When they re-emerge into the diametral region they are again accelerated and then describe second semi-circles. Repetition of this process gives the ions very high velocities. The focussing action of the electric and magnetic fields gives narrow intense beams. Using a magnet with pole faces 11 inches diameter a narrow beam of current of 10^{-9} amperes consisting of protons of 1.22×10^6 volts velocity has been obtained from a maximum applied voltage of 4,000.

In 1934, Lawrence and Livingston⁵ constructed an improved and larger apparatus of the above type, and attained a maximum speed of the hydrogen atoms corresponding to 5,000,000 electron volts the ionic current being $1/3$ microampere.

Lawrence and Cooksey have recently⁶ described their latest cyclotron called also "magnetic resonance accelerator". The pole faces of the magnet are $3\frac{1}{2}$ " apart and have a diameter of $27\frac{1}{2}$ " although the actual effective diameter of the pole faces is 42". The atomic beams can be led out into the air through thin platinum windows

and their range amounts to several centimeters in air. A still larger cyclotron is now in the making.⁷

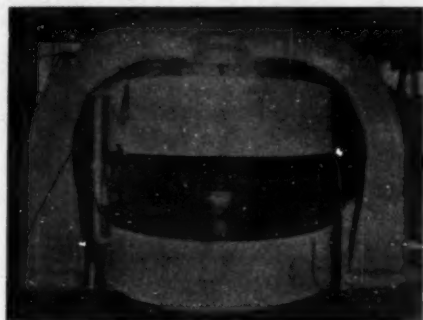


FIG. 1

The cyclotron of Prof. Lawrence. The window through which the high-speed atoms emerge out into the air is marked by the arrow-head

When high speed deuteron streams are made to fall on beryllium atoms, streams of neutrons are produced so powerful in their biological action that they are equivalent to the gamma radiations from 100 grams of radium. Accordingly, for the protection of the operator, the cyclotron is controlled from a distance of 40 feet from the apparatus with suitable intervening absorbing materials. With the deuteron streams, Lawrence has produced radioactive isotopes of many of the different elements known in the periodic table. In many cases the yields of the radio-active substances are quite large; as for example, a day's bombardment of sodium metal with 20 microamperes of 5 million volts deuterons produces more than 200 milligrams equivalent of radio-sodium, i.e., an amount of radio-sodium having a γ -ray activity equivalent to that of 200 milligrams of radium. That such large

amounts of radio-active forms of many of the elements can be manufactured in the laboratory is of immense importance in opening up new avenues of research both in the physical and in the biological sciences. Many striking results have been obtained by Lawrence himself and his co-workers, while of course, similar work on nuclear transformations is being carried out in different physical laboratories of the world by other methods as well. But the cyclotron holds a unique position in that it can provide very large yields and possesses potentialities of even greater developments which stagger the imagination of the world.

Most of Lawrence's researches were encouraged by substantial public support. The Federal Telegraph Company donated the steel castings of the magnet. The Research Corporation and the Chemical Foundation provided funds for the construction and installation of the magnet and accessory apparatus, while the operating expenses were met by the University Research Board. But above all it was the genius and the single-minded devotion of Prof. Lawrence that overcame all the practical difficulties and brought to a very successful fruition an idea that must well nigh have looked fantastic when it was originally conceived; no wonder, the world applauds.

B. DASANNACHARYA.

Benares Hindu University,
November 20, 1939.

¹ Lawrence and Swann, *Proc. Nat. Acad. Sci.*, 1931, 17, 64.

² R. Wideroe, *Arch. Electrot.*, 1929, 21, 287.

³ Sloan and Lawrence, *Phys. Rev.*, 1931, 28, 2021.

⁴ Lawrence and Livingston, *Ibid.*, 1932, 40, 10.

⁵ ———, *Ibid.*, 1934, 45, 608.

⁶ — and Cooksey, *Ibid.*, 1936, 50, 1131.

⁷ Henderson and White, *Rev. Sci. Instr.*, 1938, 9, 19.

Sedov Arctic Expedition

THE Second Anniversary of the drift of the Soviet ice breaker "Sedov" fell on the 23rd October. The drift of this breaker which bears the name of the celebrated arctic explorer, Georgi Sedov, began on October 27, 1937, in the Laptev Sea at 75° 19' N. lat. and 132° 25' E. long. The bearings on October 20 were 80° 36' N. lat. and 26° 12' E. long.

From the astronomical and meteorological data collected, it has now been established that the ice moves along isobars. This conclusion is of much practical significance, for from the data relating to the distribution of atmospheric pressures in the Arctic basin it would be possible to determine the shift of sections of ice

in the central Arctic region. The hypothesis that ice moves from East to West under the influence of winds in a circular clockwise direction, with its centre near the "pole of inaccessibility" situated between 83° and 85° N. lat., first enunciated by the Russian Arctic Expedition, headed by Toll in 1900-03, has now been confirmed. The cause for such a remarkable phenomenon is the existence of more or less permanent stretches of open water or fissures in the region north of Greenland and north of the New Siberian Islands and Wrangal Island. The depth soundings taken by the Sedov showed that at 86° 26' N. lat. and 39° 85' E. long. the depth was greater than 5,180 meters.

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On Waring's Problem

LET $G(k)$ denote the least integer s such that the Diophantine equation

$$N = x_1^k + \dots + x_s^k$$

is solvable for all sufficiently large positive integer N , where n, x_1, \dots, x_s denote positive integers.

The upper limits for $G(5)$ have been given by various writers ranging from Hardy and Littlewood to L. K. Hera. The best result known hitherto is $G(5) \leq 28$, due to Hera. The author of this note has been able to improve this to

Theorem $G(5) \leq 25$.

The author has been able to arrive at this result by improving, among other things, a theorem of Davenport on 'admissible exponents', viz., lemma 1. Suppose that $\lambda_1, \dots, \lambda_s$ are admissible exponents and that $1 - \frac{1}{k} < \lambda_i < 1$. Then $1, \lambda_1, \dots, \lambda_s$ are admissible exponents, provided that there exists an integer l satisfying

$$1 \leq l \leq k_{2-},$$

$$k\lambda_1 - (k-1) \leq \frac{1}{2^l}$$

$$(2^l - 1)[k\lambda_1 - (k-1)] + \sigma \leq l+1 (\sigma = \lambda_1 + \dots + \lambda_s).$$

This theorem is not powerful enough for

$k > 3$ since it does not lead to an admissible

set $1, x_1, \dots, \lambda_s$ such that $1 + \sigma > k - 1 + \frac{1}{2^{k-2}}$

But this can be improved by the

lemma 2. Suppose that $1, \lambda_1, \dots, \lambda_s$ are admissible exponents.

Then $1, \theta, \lambda_1\theta, \dots, \lambda_s\theta$ are admissible exponents

where $\theta = 1 - \frac{1}{k}$.

Other consequences of lemma 2 are

$$G(6) \leq 40 \text{ and } G(7) \leq 56.$$

These are also improvements on the previous results.

K. SAMBASIVA RAO.

Department of Mathematics,
Andhra University, Waltair,
October 23, 1939.

Drift of the Hysteresis Loop in Sorption

THAT "Hysteresis in Sorption" is real^{1,2,3,4,6} and is perfectly reproducible¹⁰ a large number of times in some cases and that the concept of cavities⁶ having narrow necks, is a general cause¹⁰ of the hysteresis effect, have already been established. For the non-existence or the disappearance of the hysteresis loop, however,

pressure remains the same. The permanent and reproducible hysteresis loop has also been scanned as in the case of titania gel-water.¹⁰

It is probable that this interesting colloidal behaviour of ferric oxide gel is connected with its thixotropic property. By virtue of thixotropy, the particles have the facility¹² to coalesce. Whether other thixotropic systems behave in a similar way, is a question to be decided by further investigations which are in progress.

A study of the interesting phenomena *vide infra* accompanying successive sorptions and desorptions of water vapour has thrown much light on the changes in the fine structure of ferric oxide gel. Such a study necessitating the operation of a series of sorptions and desorptions of the vapour on the same sample of the adsorbent in vacuum, has been possible by the excellent advantages of the quartz fibre spring technique.

KITTUR SUBBA RAO.

Department of Chemistry,
Central College,
Bangalore,
November 30, 1939.

¹ Allmand, Hand and Manning, *J. Phys. Chem.*, 1929, **33**, 1694.

² Burrage, *Trans. Faraday Soc.*, 1934, **30**, 317.

³ Foster, *Proc. Roy. Soc. Lond.*, 1934, **146A**, 129.

⁴ Lambert and Foster, *Ibid.*, 1932, **136A**, 363.

⁵ Leonard H. Cohan, *J. Amer. Chem. Soc.*, 1938, **60**, 433.

⁶ McBain, *Ibid.*, 1935, **57**, 699.

⁷ — *Sorption of Gases by Solids*, George Routledge and Sons, Ltd., London, 1932, 443.

⁸ Pidgeon, *Canad. J. Res.*, 1935, **12**, 41; 1934, **10**, 713.

⁹ Rao, K. S., *Curr. Sci.*, 1939, **8**, 256.

¹⁰ —, *Ibid.*, 1939, **8**, 468.
¹¹ —, and Rao, B.S., *Proc. Ind. Acad. Sci.*, 1936, **4**, 562.

¹² Weiser, *The Colloidal Salts*, John Wiley & Sons, Inc., New York, 1933, **3**, 374.

Threshold Potentials and Reactivity under Electrical Discharge

It was observed earlier¹ that time-variations in the electrical quantities such as the magnitude of the ionisation current flowing through,

and the energy consumed in the reaction space were of significance in an analysis of the corresponding reaction-time curves. These studies were carried out in Geissler-, triode-type vessels and in the annular space of the Siemens' ozoniser. For a variety of reasons, especially the possibility of enabling an exposure of a pre-determined mass of a gas to a field which can be calculated with a fair precision on a comparatively simple theory,³ the last type of the vessel is well adapted. A factor which has hitherto been practically entirely ignored by workers in the field of reaction kinetics under electric discharge, has now been observed in the existence of a threshold potential, V_m ; this minimum of potential has to be exceeded in order to initiate the change in a given reactant material, which may be (a) pure or (b) a mixture. Almost in every case (the possibility of the explosive reactions constituting a general exception is being investigated) there is a sudden change, usually an increase, in the current through, and the wattage dissipated, in the system, besides the familiar manometric or chemical indication of an insipient reaction, at V_m . It is characteristic both of the reaction and nature of the material. The V_m values for (a) are identifiable with, or simply related to the corresponding Paschen potentials; work is now in progress on the position in respect of (b).

It has been found that a determination of V_m , the threshold potential, serves markedly to throw light on the mechanism of a complex, especially a consecutive chemical reaction. Curves in Fig. 1 illustrate the variation of V_m for the reactant material determined at different times during the decomposition of nitric oxide

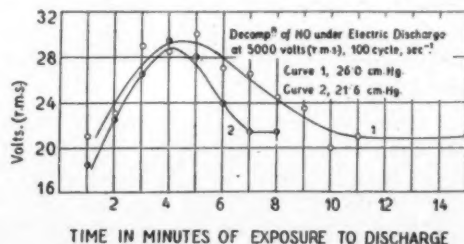


Fig. 1

due to 5000 volts (r.m.s.) at two initial pressures. They are remarkably similar to the familiar concentration-time curves characteristic of the intermediate compounds in consecutive reactions. This, together with a general finding in these Laboratories that admixture even in traces of a component with a large 'electron affinity' increases V_m , suggested the intermediate occurrence of nitrogen peroxide in the decomposition of nitric oxide under the discharge. Later, this deduction was fully confirmed by direct optical and analytical examination of the decomposition mixture at the intermediate stages of the reaction. This examination entails on the one hand, an accessory and by no means simple manipulation, and is liable on the other, to disturb the chemical state of the mixture. Such limitations are, however, absent in the threshold potential determinations, which can be carried out with the reaction mixture *in situ*, whilst giving an adequate indication of the occurrence of any intermediate reaction, and are of general applicability.²

Further work has shown that the threshold potential measurements are markedly sensitive to change, when a discharge reaction is produced under an *additional* constraint, such as irradiation, a magnetic field, an altered temperature or frequency of the A.C. supply. Moreover, even in such quasi-chemical changes, as the induction of the 'latent image' on a photographic plate, activation of nitrogen, its deactivation, or spectral shift in the 'after glow', V_m has been found to be the chief determinant of both their inception and time rate.

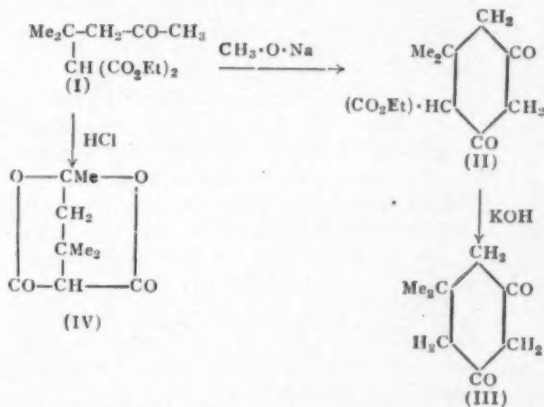
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November 8, 1939.

Reformatsky Reaction with Ethyl Bromomalonate and Acetone

THE classical Reformatsky Reaction,^{1,2} for the synthesis of β -hydroxy esters has been studied by several workers with α -halogen esters of various monocarboxylic acids on ketones or oxides. The study of this reaction is now being pursued with α -halogen esters of dicarboxylic acids.

Instead of giving the expected β -hydroxy ester, the condensation of ethyl bromomalonate with acetone in presence of zinc, follows an unexpected course where one molecule of the ester reacts with two molecules of the ketone leading to the formation of ethyl acetonyl-*iso*-propyl-malonate (I), b.p. 125–137°/4 mm. (semicarbazone m.p. 74–75°). The results of analysis, the molecular weight determination and its cyclisation with sodium methylate to Vorländer's ester³ (II)—not isolated—with subsequent hydrolysis to 5:5-dimethyldihydroresorcin⁴ (III) definitely establishes the identity of (I). On hydrolysis with hydrochloric acid, ester (I) gives the dilactone (IV) m.p. 135–136°.



Qudrat-i-khuda⁵ has prepared (II) and (IV) from 6-hydroxy-2-keto-3-cyano-4:4:6-trimethylpiperidine obtained by the condensation of mesityl oxide with cyanacetamide. A comparison of the present products with those of Qudrat-i-khuda also confirmed their identity.

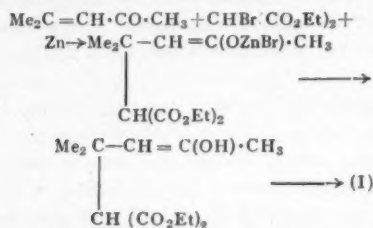
The mechanism of the reaction is explained

¹ Joshi, *Trans. Farad. Soc.*, 1927, **23**, 227; 1929, **25**, 108, 138, 143.

² ———, *loc. cit.*, 1929, **25**, 120.

³ Warburg, *Ann. Physik*, 1909, **28**, 1–17; Lunt, *Phil. Mag.*, 1925, **49**, 1238.

as follows. First of all two molecules of acetone condense to form mesityl oxide. Afterwards, in analogy with the observations of Kohler *et al.*,⁶ the zinc compound of ethyl bromomalonate adds on to it in 1:4-positions leading to the formation of (I) as under.



The full paper will be published elsewhere.

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Indian Institute of Science,
Bangalore,
December 10, 1939.

¹ Reformatsky, *J.R.C.S.*, 1890, **22**, 49; *British Chemical Abstracts*, 1891, **60**, 169.

² W. H. Perkin, *J.C.S.*, 1896, **69**, 1482.

³ Vorländer, *Annalen*, 1897, **294**, 300.

⁴ —, and Erig, *Ibid.*, 1897, **294**, 314.

⁵ Qudrat-i-khuda, *J.C.S.*, 1929, 201.

⁶ Kohler, Heritage and Macleod, *Amer. Chem. J.*, 1911, **46**, 217.

Magnetic Susceptibilities of Some Fluorides

THE susceptibilities of fluorides of Li, Na, S, K, Ca, Mn, Co, Ni, Ge, Se, Rb, Sr, Mo, Te, Cs, Ba, W, Tl, Pb, U, Ce and Nd have been already studied by various investigators.^{1,2}

Susceptibilities of fluorides of Mg, Al, Cd, Cr, Fe, Cu, Zn, Ce, Hg, Bi and fluoride of KBe have now been determined by me using the usual Gouy method.

The electromagnet was constructed in our laboratory. It gives a maximum field of 13,000 Gauss at 22 Amp. and 110 volts with an air gap of 1.0 cm. All the salts except MgF_2 (Kahlbaum, Berlin), KBeF_2 and FeF_3 (Chémiche Fabric, Gorlitz), were prepared by British Drug House, London. They were packed in thin glass tubes

and the mass susceptibilities were calculated by the usual formula,

$$F_x = \frac{1}{2}A(K_1 - K_2)(H_1^2 - H_2^2)$$

where A is the area of cross-section of the specimen, F_x is the magnitude of the force on the specimen, K_1 and K_2 the volume susceptibilities of the specimen and the medium respectively, and H_1 and H_2 the fields at the lower and upper ends of the specimen. (Volume Susceptibility = Density \times Mass Susceptibility.)

The results after applying various corrections are as follows:—

Salt	Temperature	Mass Susceptibility $\times 10^6$
	°C.	
MgF_2	28.0	+ 0.40
AlF_3	29.2	— 0.16
CdF_2	29.0	— 0.25
CrF_3	32.0	+ 91.20
FeF_3	32.0	+ 122.00
CuF_2	32.2	+ 23.60
ZnF_2	26.6	— 0.37
CeF_3	29.0	+ 10.90
		(standard value ³ = 11.10 at 20° C.)
BiF_3	29.8	— 0.23
HgF_2 (oxy)	29.0	— 0.26
HgF_2 (ous)	29.0	— 0.24
KBeF_2	28.6	— 0.60

Detailed account will be published elsewhere.

I am grateful to Mr. U. Durrani, Superintendent, Technical Institute, Muslim University, Aligarh, for his kind help in constructing the electromagnet and helpful discussions.

ABDUL AWWAL CHOWDHURY.

Physical Laboratories,
Muslim University,
Aligarh,
November 30, 1939.

¹ *A.T.C.*, Paris, 1937, **8**, 23—2.

Ibid., 1937, **17**, 23—6.

² Landolt's Bornstein, *Tables of Constants*, Springer, Berlin, 1923, **2**, 1198; 1936, **3**, 2180.

³ —, *Ibid.*, 1936, **3**, 2181.

Growth Promoting Factors in Jowar (*Andropogon Sorghum* Linn.)

IN the course of our feeding experiments with the rice moth, *Careya cephalonica*, it was found that the insect needs a water-soluble factor and also one which is fat-soluble. Whole jowar, dried and powdered to pass through a 30-mesh sieve, when fed to these insects, has been found to constitute an adequate diet, but the material subjected to an extraction with ether, does not support the growth of the insect, although the diet is supplemented with an equivalent quantity of fat in the form of groundnut oil. The addition of the ether extract to the extracted meal, however, restores the adequacy of the diet, although the diet suffers in quality to a certain extent. This deterioration in quality is attributed to a partial destruction of the fat-soluble factor in the course of the preparation of this diet.

Batches of ten larvæ were fed on three different diets (1) whole jowar, (2) jowar extracted with ether but the fat deficiency made up by groundnut oil and (3) ether extracted jowar to which an equivalent quantity of the extract has been added. Results of these experiments have been graphically represented in Fig. 1, which

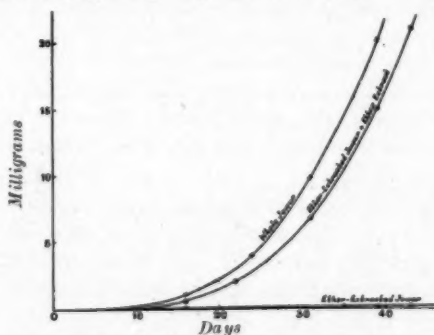


FIG. 1.
Growth curves of the rice moth (*Careya cephalonica*)
fed on different diets

Scale—x axis 1 cm. = 2 days
y axis 2 cm. = 2.5 mgms.

demonstrates in a convincing manner, the presence of a potent fat-soluble, growth-promoting factor in the ether extract. Experiments

with a view to isolate this factor in a concentrated if not a pure form, are now in progress.

P. S. SARMA.

M. SREENIVASAYA.

Department of Biochemistry,
Indian Institute of Science,
Bangalore,
December 5, 1939.

Nitric Nitrogen in Soils under Cotton

A GENERAL complaint in the cotton growing districts of the Punjab is that American varieties of cotton do not often give successful crops. At the flowering stage the plants usually become yellowish green in colour, and at times there is a considerable shedding of leaves and flowers and bad opening of bolls. This trouble has also been encountered in Sind.

Since soils in tropical countries are generally deficient in nitrogen, the yellowish green appearance of plants led us to suspect nitrogen starvation at the time of seed formation when it is most required. Preliminary observations on the amount and type of nitrogen in soils under cotton were taken in 1928. These showed a deficiency of available nitrogen in such soils.

In 1929 and again in 1933, with the assistance of the Cotton Research Botanist weekly determinations of different forms of nitrogen were made during the entire cotton season. These were correlated in 1929 with the types of micro-organisms present in fallow and the cropped soils.

The results of such observations (Table I) showed that the amount of nitric nitrogen in soils under cotton was practically nil from about the end of July onwards.

Another set of observations was taken in September this year (1939). Determinations for available nitrogen were made in samples of soil removed from 16 different fields under American cottons at Risalewala and Lyallpur Agricultural Farms. The amount of available nitrogen was found to be practically nil in all these (Table II).

TABLE I
Mgm. Nitric Nitrogen per 100 gms. of Soil

Year 1929			Fallow	Under Cotton	Year 1933			Fallow	Under Cotton
29th July ..	..	1.43		Nil	31st July ..	..	1.2		0.56
5th Aug. ..	..	1.80		Nil	7th Aug. ..	..	1.2		0.33
10th „ ..	..	2.14		Nil	14th „ ..	..	1.27		0.71
19th „ ..	..	1.31		Nil	21st „ ..	..	1.50		0.90
26th „ ..	..	1.65		Nil	27th „ ..	..	0.70		Trace
2nd Sept. ..	..	2.00		Nil	11th Sept. ..	..	0.33		0.18
10th „ ..	..	1.90		Nil	18th „ ..	..	1.01		0.52
17th „ ..	..	1.62		Nil	25th „ ..	..	0.63		0.30
23rd „ ..	..	1.50		Nil	2nd Oct. ..	..	0.00		0.22
2nd Oct. ..	..	2.90		Nil	9th „ ..	..	0.35		0.09
7th „ ..	..	1.50		Trace	15th „ ..	..	0.52		0.11
21st „ ..	..	2.85		„	23rd „ ..	..	0.52		0.22
30th „ ..	..	2.92		„	30th „ ..	..	0.52		0.26
5th Nov. ..	..	2.85		„	6th Nov. ..	..	0.90		0.27
12th „ ..	..	2.30		0.62	12th „ ..	..	0.60		(0.15)
20th „ ..	..	2.80		0.58	20th „ ..	..	0.9		0.11

TABLE II
Mgm. Nitric Nitrogen per 100 gms. of Soil

S.No.	Field No.		Variety of cotton	Nitric N. Mgm.	S. No.	Field No.		Variety of cotton	Nitric N. Mgm.
1	Risalewala Farm	B/8	43F	Trace		Lyalpur Agricultural Station			
2	„ „	B/10	43F	„	9	„ „	3/23	L.S.S.	Nil
3	„ „	B/12	43F	Nil	10	„ „	3/24	K.T.25	„
4	„ „	E/4	L.S.S.	„	11	„ „	3/25	L.S.S.	„
5	„ „	E/8	L.S.S.	„	12	„ „	4/21	L.S.S.	„
6	„ „	E/12	L.S.S.	0.02	13	„ „	5/10	L.S.S.	„
7	„ „	H/1	L.S.S.	Nil	14	„ „	5/11	L.S.S.	„
8	„ „	H/2	L.S.S.	„	15	„ „	5/20	L.S.S.	„
					16	„ „	5/21	L.S.S.	„

Besides nitric nitrogen, estimations of nitrous and ammoniacal nitrogen were also made. Nitrous nitrogen was found to vary from 1/100th to 1/20th of a mg. per 100 gms. soil while ammoniacal nitrogen was generally present in traces only.

It appears, therefore, that deficiency of available nitrogen in soils under cotton at the fruiting stage of the crop may have something to do with its partial failure.

M. R. MADHOK.
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Bacteriological Research Laboratories,
Agricultural Research Institute,
Lyallpur,
October 6, 1939.

Occurrence of Celestite in the Phosphatic Nodules of Utatur

SEVERAL investigators^{1,2,3} have reported on the extensive deposits of phosphatic nodules in the Utatur area. Crushed specimens of phosphatic nodules revealed the presence of a white platy mineral which filled the cracks in the nodule and appeared to have concentrated near the core. Since it could be easily loosened and isolated and also since it comprised more than 3 per cent. (even 10 per cent. in exceptional cases) of the entire nodule, it was obtainable in sufficient quantity for study.

A careful chemical examination which involved the separation of calcium, strontium and barium by reliable methods showed that the mineral consisted approximately of 93 per cent. of strontium sulphate, 4 per cent. of the sulphates of calcium and barium and 3 per cent. of quartz.

We have also examined a lump of celestite occurring in the gypsum beds in the same area. This specimen was a massive aggregate of columnar crystals each of which was 10-12 mm. long.

In view of the fact that no significant deposits^{4,5,6,7} of strontium minerals in India have so far been known to exist, this finding of a large source of strontium compounds in the Utatur area appears to be of some importance to this country.

A detailed study of the occurrence of celestite

and of other minerals occurring in the Utatur area is now in progress.

N. JAYARAMAN.

K. R. KRISHNASWAMI.

Dept. of General Chemistry,
Indian Institute of Science,
Bangalore,
December 12, 1939.

¹ Blanford *Mem. Geol. Surv. Ind.*, 1862, 4, 83.

² Sivan, *Year Book of the Mad. Agric. Dept.*, 1918.

—, *Proc. Ind. Sci. Cong.*, 1922, 29.

—, *Ibid*, 1924, 44.

³ Rama Rao, *Quart. Jour. Geol. Min. Met. Soc. Ind.*, 1931, 4, 49.

⁴ Blanford, *Mem. Geol. Surv. Ind.*, 1880, 17, 196.

⁵ Coggin Brown, *India's Mineral Wealth*, 1936, 277.

⁶ Jones, *Rec. Geol. Surv. Ind.*, 1888, 21, 36.

⁷ Hughes-Buller, *Ibid.*, 1904, 31, 45.

A Note on the Effect of Indole-butyric and Indole-acetic Acids on Rooting of Green Wood Cuttings with Special Reference to Litchi and Mango

PRELIMINARY results obtained during the summer of 1939 definitely indicate the effectiveness of indole-butyric acid in stimulating root growth in cuttings of litchi and a hedge plant, namely, *Justicia gendarusa* Linn. The time allowed (60 days) was found too short for rooting in mango but the effect of the chemicals was evident in callus growth. The importance¹ of propagation by cutting, if really practicable, would be very great in litchi and mango. The present methods of marcotting of litchi, and inarching of mango using seedling stocks are not only tedious but also do not give satisfactory results.

In the present experiments, cuttings about 6 inches in length were taken from one- and two-year old shoots, during the last week in March 1939. All leaves were removed and the cuttings immersed to a depth of about 1 inch in various concentrations of a water solution (tap water) of indole-butyric and indole-acetic acids for 6, 12, 24 and 48-hour periods. After treatment the cuttings were planted to about two-third of their length in a sand bed. These were excavated after 60 days. The *justicia* sp.

is not difficult to root. Ordinarily it is propagated by cuttings and, therefore, it was used in these experiments with a view to provide a check on the methods employed.

Between the two acids, indole-butyric was found more effective and in all cases maximum effect was obtained where the highest concentration was applied for the longest period. Fig. 1 is a photograph showing the effect

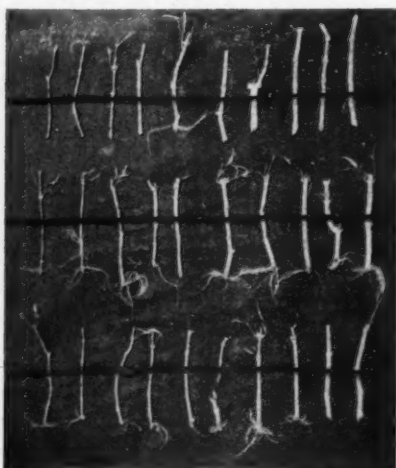


FIG. 1

Showing rooting in *Justicia gondarusa* cuttings, the top line shows the controls, the middle line the ones treated with indole-butyric acid and the bottom line treated with indole-acetic acid.

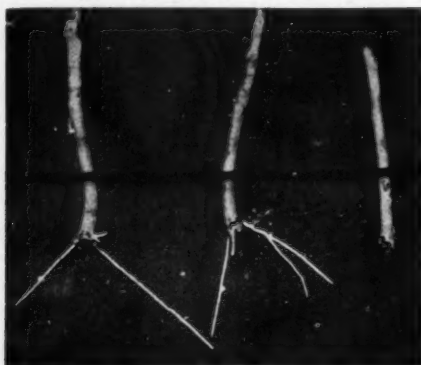


FIG. 2

Showing rooting on *Litchi* cuttings treated with indole-butyric acid.

on *justicia* cuttings of the three treatments, namely, control, 60 mgr. indole-butyric acid per litre and 48-hour period, and 60 mgr. indole-acetic acid per litre and 48-hour period on the top, middle and bottom rows respectively. Fig. 2 shows rooting in litchi cuttings. In this case actual rooting was obtained only under the treatment of 60 mgr. indole-butyric acid per litre and 48-hour period. The detailed data of these experiments have been presented in the *Annual Report of the Fruit Research Station, Sabour, for 1938-39*.

Thanks are due to the Imperial Council of Agricultural Research as this work has been taken up at their instance under a Scheme financed by them.

P. K. SEN.

Fruit Research Station,
Sabour, Bihar,
August 18, 1939.

¹ Sen, P. K., *Hort. Res. Sta. of U.P. and Bihar*, Sabour, 1937-38, Pt. II, pp. 54-60.
Tanaka Tyozburo, *Phil. J. Agri.*, 1939, 10, No. 1.

'Thermo' or 'Vacuum' Flasks for Preserving Sugarcane Pollen

SUGARCANE pollen loses viability fairly quickly—sometimes in less than four hours—under the ordinary field or laboratory conditions. Experiments in the past had, however, shown that under conditions controlled for temperature and humidity certain sugarcane pollens can be preserved for as many as nearly thirteen days.^{1,2} A simple, cheap and portable arrangement for thus preserving the pollen had, however, been a desideratum.

The device illustrated herein (Fig. 1) utilising the easily available thermo or vacuum flask has shown usefulness in preserving cane pollen already for the period above mentioned and the periodical testing for viability is still in progress.

A is a test tube, rubber stoppered at the top, carrying a specially designed staging M in which cane pollen of four different kinds could be stored in small watch glasses. This tube A is the store chamber for the pollen desired to be preserved. H is a mixture of sulphuric acid and water in suitable proportions for securing

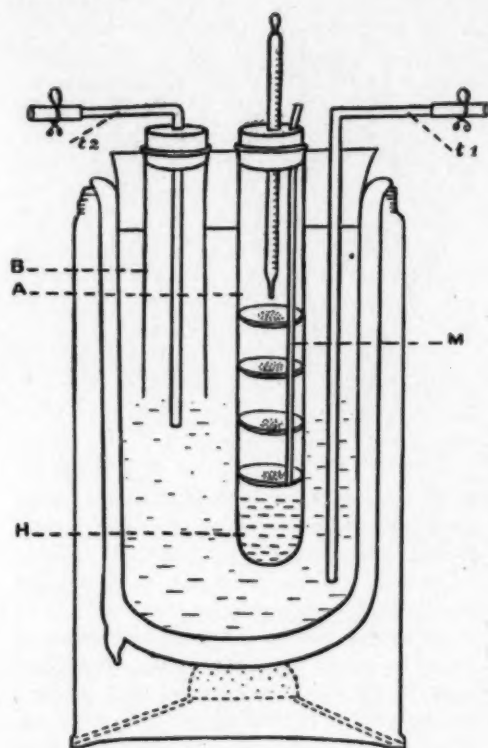


FIG. 1

the humidity desired. The tubulatures t_1 and t_2 are for maintaining the water inside the flask and hence the atmosphere inside the pollen store chamber at the desired temperature. This is secured by introducing through the tube B calculated quantities of ice based on the general formula for the measurement of heat of fusion of ice by its mixture with water. Either of the tubulatures may be utilized for letting out the water from the flask as needed by the well-known syphon principle.

The apparatus illustrated is simple, made from easily available material like the thermo food jar and has the great advantage of portability. It should, therefore, be of particular use when pollen has to be transferred over distances. It has been possible with this device to maintain the temperature in the test tube in which pollen is kept for storage at fairly

constant temperatures ranging from 5° C. to 16° C. with a variation of 1.8° C. during a period of two days after which a suitable recharging is needed.

M. VIJAYASARADHY.

Imperial Sugarcane Station,
Lawley Road, Coimbatore,
November 24, 1939.

¹ Vekataraman, *Agri. Jour. Ind.*, 1922, 17, 127.

² Dutt, *Ibid.*, 1929, 24, Pt. IV, 255.

On Resistance of Vernalised Plants of Linseed to attack by *Melampsora Lini*

DURING the course of investigation by Mr. Gurbachan Singh (1938-39 session) on the effect of different periods of pre-sowing cold treatment of certain plants, an important observation was made, viz., treated linseeds were found to be less liable to the attack of the rust, *Melampsora Lini* than the untreated ones. Linseed seeds T_5 and T_{10} from Lyallpur were given pre-sowing cold treatment. These along with the control plants were grown in small plots in the Botanical Garden, where Linseed varieties E.B.Z. and O.S.X. from Nagpur were also growing in contiguous plots. The latter two are susceptible varieties and were attacked by the rust early in March. From these, first the control plants of T_{10} and a few days later the control plants of T_5 were infected. The treated plants were the last to be infected and those treated for the longest period, viz., two weeks (other sets were exposed to cold for 1½ and 1 week) had very little rust infection and many of the plants escaped infection altogether and those that were infected, showed very little actual damage. The experiments are being repeated this session and the details of these experiments will be published by Mr. Gurbachan Singh as soon as completed.

So far very little evidence of resistance to disease due to vernalisation in plants is available. Only positive evidence is that of Nemlienko on resistance of vernalised plants to bunt disease. The present evidence of resistance to

rust seems to have great potentiality. It is being tried on wheat plants for resistance to different wheat rust and the result will be published in due course.

H. CHAUDHURI.

Panjab University,
November 25, 1939.

A Note on the Structure and Development of the Ovule and Embryo-sac in Two Species of *Launea*

THE literature on the embryology of the Indian members of the family *compositae* is limited to the works of Bhargava¹ on *Eclipta erecta* and Banerji² on *Carthamus tinctorius*.

The writer has for some time been studying the embryology of some Indian members of the above family and the present note deals with the structure and development of the ovule and embryo-sac in *Launea nudicaulis* and *Launea pinnatifida*. When my observations were almost ready for being sent to the press, Sunil Datta³ published a note on the development of the female gametophyte in *Mikania cordifolia*, *Blumea laciniata* and *Launea asplenifolia*. My observations on the two species of *Launea* agree in all respects with his except in the development of the 'cover cells'.

In the two species forming the subject of this note the single basal ovule is anatropous and one-integumented. It has a very scanty nucellus. The single archesporial cell is hypodermal. It directly becomes the megaspore mother-cell without cutting off a cover cell. On completion of the first and second meiotic divisions the megaspore mother-cell forms a linear tetrad (Fig. 1). The chalazal megaspore is the functional one and forms the uni-nucleate embryo-sac. The three micropylar megaspores degenerate. A normal 8-nucleate embryo-sac is formed from the uni-nucleate embryo-sac after three successive free nuclear divisions in it. The embryo-sac shows the normal structure. The egg has the usual form, with a prominent micropylar vacuole and the nucleus in the dense cytoplasm at the chalazal end. The two synergids lying on either side

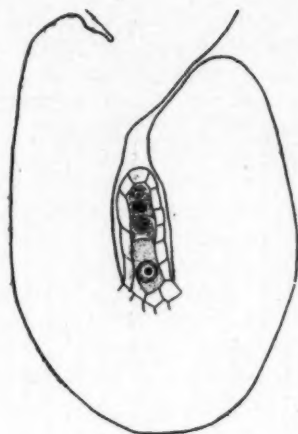


FIG. 1

of the egg are pear-shaped with pointed micropylar ends which are filled with dense cytoplasm. They have a nucleus each in the micropylar part and bear the usual chalazal vacuoles. The antipodals are uni-nucleate and are formed either in a row or arranged in a triangular form in the chalazal end of the embryo-sac. The polar nuclei meet at about the middle of the embryo-sac and move upwards. They fuse with each other and form the secondary nucleus which finally takes its position near the egg. The fertilization is porogamous.

The single layer of nucellus begins to degenerate at about the time when the embryo-sac becomes two-nucleate (Fig. 2). By the time the embryo-sac attains the mature form the whole nucellus disappears and the embryo-sac lies within the jacket of cells formed by the innermost layer of cells of the single massive integument (Fig. 3). The cells of this layer get a little elongated, become rich with protoplasmic contents and serve as the tapetum. This is found in many *compositae*. According to my observations in the two species of *Launea*, neither the megaspore nor the embryo-sac becomes deep-seated due to the development of cover cells. Sunil Datta in his note states that in the species he studied, the megaspores become deep-seated due to the development of

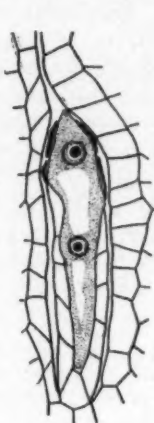


FIG. 2

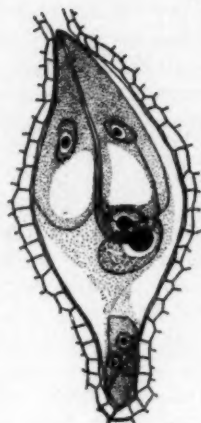


FIG. 3

cover cells, although he himself states in an earlier part of his note that the single hypodermal archesporial cell functions directly as the megaspore mother-cell. When a cover cell is not cut off primarily there could be no further development of cover cells to make either the megaspore or any structure resulting from it deep-seated. The extensive literature cited by Schnarf⁴ in his book in connection with the embryology of *compositae* and the observations made more recently by Bhargava on *Eclipta erecta* and Banerji on *Carthamus tinctorius* are in complete accord with my observations.

A detailed account of the development of flower, pollen, ovule, embryo-sac and embryo will be published elsewhere in due course.

J. VENKATESWARLU.

Andhra University,
Waltair,
November 1, 1939.

¹ Bhargava, H. R., *Proc. Ind. Acad. Sci.*, Series B, 1935, 1, No. 7.

² Banerji, I., *Proc. Ind. Sci. Cong.*, Part III, 1938.

³ Sunil Datta, *Curr. Sci.*, 1939, 8, 472.

⁴ Schnarf, K., *Vergleichende Embryologie Der Angiospermen*, 1931.

The Age of the Earth

(According to the Hindu 'Shastras')

VERY little reference has been made to the views expressed in the religious books ('Shastras') of the Hindus when tracing the evolution of ideas about the age of the earth. Shand¹ does not refer to them at all; whereas Holmes only says, "Opposed to these limited ideas of a definite beginning, the old Brahmins of India regarded time and the earth as eternal".²

Both in the *Sankhya* and in the *Vedanta* philosophy of the Hindus, the Creation and Destruction of the World have been regarded as Cyclic in nature, like day and night. The total time of the Creation has been termed a "Kalpa" or a day of 'Brahma', the Creator. According to the ancient books of the Hindus—both socio-religious and astronomical, like the *Manu Smriti* (Chap. 1, stanzas 63-73) and the *Surya Siddhanta* (Chap. 1, stanzas 15-20)—a "Kalpa" is composed of 14 'Manvantaras' together with 13 time-intervals between them, each interval being of 1,728,000 years. Each 'Manvantara' itself is composed of 71 cycles of 'Chaturyugas'. A 'Chaturyuga' is the sum of four 'yugas' or eras, including the time-intervals between each of them. The four eras are 'Satya-yuga', 'Treta-yuga', 'Dwapur-yuga' and 'Kali-yuga'. Kali-yuga is of 432,000 years' duration, and Dwapur, Treta and Satya yugas are respectively double, treble and four-times the Kali-yuga. The figures for the various eras include also the time-interval which precedes and follows each era. From these figures, the duration for which this World is supposed to last is estimated to be 4,320 million years.

The age of the Earth from its beginning to the present time is termed in Hindu astronomical Calendars as 'Shrishti-Samvat' (year of Creation), and is often recited by the Hindus in the 'Sankalpa Mantra' during their religious rites. In this recitation of a few lines, the Hindu is reminded that since the beginning of the Creation of this world, six 'Manvantaras' and 27 'Chaturyugas' have already passed away, and we are at this time in the 5040th year (in

A.D. 1939) of the 'Kali-yuga', the last era of the 28th 'Chaturyuga'.³ The total time through which the earth has already endured thus works out to be 1,972,949,040 years in the Hindu Calendar. It is wonderful how this "Srishti-Samvat" of the Hindus agrees so well with the recent geo-physical estimates of the age of the earth (about 2,000 million years).

N. L. SHARMA.

Indian School of Mines,
Dhanbad,
November 21, 1939.

¹ Shand, S. J., *Earth lore*, 1927, 42.

² Holmes, A., *The Age of the Earth* (Benn's Library Series), 1928, 5.

³ Tilak, B. G., *Shrimad Bhagwat Gita Rahasya*, Hindi Edition, 1919, 193.

The Constitution of Rottlerin

MCGOOKIN, Robertson and Tittensor¹ have advanced a new structure for rottlerin still retaining the CH_3CO group. We shall publish our detailed criticism of this formula as soon as our experiments in progress are completed. In the meanwhile we wish to point out that a solution of 0.5 gr. of rottlerin methyl ether² described by us, dissolved in 25 c.c. of chloroform when taken in a 2 dcm. tube showed a rotation of $+0.23$ whence the specific rotation is $+5.75$. Therefore, rottlerin has an asymmetric carbon atom which we do not find in Robertson's latest formula.

With regard to Robertson's criticism³ that 'Ray and co-workers maintain that this compound contains a lactone group and also state that in the conversion of tetrahydrotrotlerin into octahydrotrotlerinone by hot alcoholic hydrochloric acid, an acidic substance is formed which apparently is an intermediate product in the rottlerinone change. We have repeated the experiments described by the Indian workers and it may be stated that if the experiment is stopped after 8 hours, as these authors describe, the insoluble product appears to consist

only of octahydrotrotlerinone along with unchanged tetrahydrotrotlerin, which in a finely divided state we have observed to be soluble in aqueous sodium bicarbonate.' They draw the conclusion that no acidic products are formed and sodium bicarbonate only dissolves the precipitate to a colloidal solution. We wish to state that we have definitely stated that the product is a mixture and did not claim it to be a pure product. We know there is some unchanged tetrahydrotrotlerin and a little tetrahydrotrotlerinone in it but when the mixture is treated with bicarbonate, a good portion remains insoluble. The portion soluble in the bicarbonate solution has now been repeatedly extracted with ether and then on acidification with hydrochloric acid has deposited this acidic substance. The acidic substance so precipitated is freely soluble in ether. The ethereal extract has now been washed nine times with water and tested for the absence of chlorine ion. A few drops of this ethereal solution readily liberates iodine from an aqueous solution of potassium iodide and iodate thus establishing the presence of an acidic substance in the ethereal solution. We are also determining the pH of this ethereal solution. From the above it will be evident that the solution of a portion of the mixture in bicarbonate solution is due to salt formation and not to colloidalisation as Robertson supposes.

We thank Professor Mahan Singh of the Government College, Lahore, for taking the optical rotation for us.

J. N. RAY.

K. S. NARANG.

B. S. ROY.

University Chemical Laboratories,
University of the Panjab,
Lahore,
December 16, 1939.

¹ *J.C.S.*, 1939, 1582.

² *Ibid.*, 1937, 1864.

³ *Ibid.*, 1939, 1583.

The Use of Kamala as an Antioxidant of Ghee

By S. V. Govindarajan and B. N. Banerjee

(Department of Biochemistry, Indian Institute of Science, Bangalore)

THE problem of prevention of rancidity in natural fats and food preparations containing fats is one which has received considerable attention. The conditions responsible for or favourable to fat deterioration have been well studied. The remarkable variations in the resistance of butterfat to rancidity, and of the vitamin A in the fat to destruction by heat and oxygen, have been attributed to the presence in different amounts of protective substances (Banerjee¹). Antioxidants and pro-oxidants (promoters) for the control of autoxidation are being increasingly applied in industries. Investigations in the oil and rubber industries in particular have discovered a large range of substances which may be employed to modify the reaction velocity or totally to prevent the deterioration of a product by oxidation or polymerisation.

The work of Olcott and Mattil² has shown that three types of substances have a protective action on the oxidation of animal fats (lard): (i) the acid type inhibitors, (ii) the unsaponifiable matter obtained from various vegetables and vegetable oils, and (iii) the phenolic type, e.g., hydroquinone, α -naphthol, pyrogallol, catechol and others. Substances of type (i) can scarcely be added to sensitive foodstuffs like butterfat to help preservation, whilst the use of substances in concentrations exceeding 0.01 or 0.02% of the other types is likely to interfere with taste, flavour, etc.

A search for a substance of such nature that little objection could be taken from these points, has revealed that Kamala dye is satisfactory. It is of vegetable origin, is harmless, odourless and very stable. When dissolved in fats in small amounts it gives a light yellow colour, which is natural to butterfat of good quality. The dye is not soluble in water, but an alcoholic solution dissolves easily in fat.

The effect of the addition of this substance in small concentrations on the oxidation of fat as measured by oxygen absorption at 95° C. is summarised in Table I.

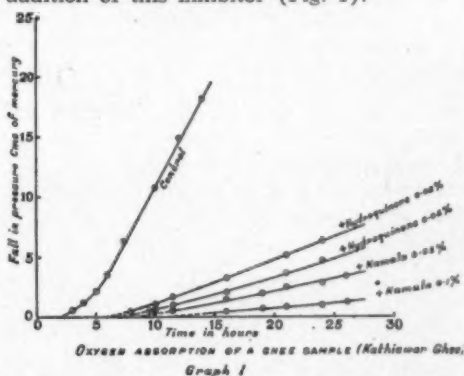
It is seen that the induction period is considerably increased by the addition of even 0.02% of Kamala dye. The rate of

TABLE I
Substrate Kathiawar Agmark Ghee

Inhibitor added %			Induction period* with inhibitor hours	Anti-oxidative index
0.02	Hydroquinone ..	..	6.0	3.0
0.05	" ..	..	7.0	3.5
0.02	α -naphthol ..	..	5.0	2.5
0.02	Kamala dye ..	..	8.5	4.25
0.05	" ..	..	9.5	4.75
0.10	" ..	..	11.0	5.5
0.02	Citric acid ..	..	2.0	1.0
0.20	" ..	..	4.5	2.25
0.02	Tartaric ..	..	2.0	1.0
0.20	" ..	..	3.5	1.75
0.20	Lactic acid ..	..	2.5	1.25
0.50	" ..	..	1.5	0.75
0.20	Oleic acid ..	..	1.5	0.75
0.50	" ..	..	1.0	0.5

* Induction period for control 2 hours.

oxygen absorption is also reduced by the addition of this inhibitor (Fig. 1).



Several substances such as oxalic acid,³ maleic acid,⁴ sulphuric acid and phosphoric acid and their salts⁵ and lecithin⁶ have been suggested as antioxidants for vegetable fats. Addition of organic acids like citric, tartaric and lactic acids does not increase the period of induction in butterfat, while oleic acid has been found to shorten it. But, when the acids are added along with the inhibitors, a considerable increase in the

antioxidative activity is noted. This synergistic effect is particularly noticeable with oleic acid (Table II).

TABLE II
Synergetic effect of organic acids and inhibitors

Substrate Kathiawar Agmark Ghee

Inhibitor mixture %	Induction period* with inhibitor hours	Anti-oxidative index
0.2 Oleic acid		
+0.02 Hydroquinone ..	23	11.5
0.5 Oleic acid		
+0.02 Hydroquinone ..	36	18
0.2 Oleic acid		
+0.02 Kamala dye ..	78	39
0.5 Oleic acid		
+0.02 Kamala dye ..	>86	>43
0.5 Oleic acid		
+0.05 Kamala dye ..	>86	>43
0.02 Citric acid		
+0.02 Kamala dye ..	9	4.5
0.2 Citric acid		
+0.02 Kamala dye ..	19.5	9.75
0.02 Tartaric acid		
+0.02 Kamala dye ..	12	6
0.2 Tartaric acid		
+0.02 Kamala dye ..	26	13

* Induction period for control 2 hours.

This behaviour resembles that observed by Olcott and Mattil² who found that mixtures of orcinol and phosphoric acid prolong the period of induction in lard to a greater extent than either substance individually. It seems likely that the observation of Holmes, Corbet and Hartzler⁷ on the superior stabilizing effect of combinations of lecithin and hydroquinone on vitamin A over that of either alone, is a case not dissimilar to the one recorded here. The advantages of using mixtures like oleic acid and Kamala instead of the abovementioned antioxidant mixtures of lecithin, phosphoric acid and other objectionable compounds are obvious.

The sample of Kamala dye was provided by Dr. S. Krishna, Biochemist, Forest Research Institute, Dehra Dun, to whom the authors' thanks are due.

¹ Banerjee, *Agric. & Livestock in India*, 1938, **8**, 173.

² Olcott and Mattil, *J. Amer. Chem. Soc.*, 1936, **58**, 2204.

³ Rogers, *C.A.*, 1932, **26**, 613; *U.S. Patent*, 1,826,258.

⁴ Greenbank and Holmes, *Ind. Eng. Chem.*, 1934, **26**, 243.

⁵ Eekey, *U.S. Patent*, 1,982,907.

Richardson, Vibrans and Andrews, *C.A.*, 1935, **29**, 518, 2770.

⁶ Bollman, *Ibid.*, 1923, **17**, 3234.

⁷ Holmes, Corbet and Hartzler, *Ind., Eng. Chem.*, 1936, **28**, 133.

OBITUARY

Dr. Gopal Chandra Chakravarti

IT is with deep regret that we record the tragic and premature demise of Dr. Gopal Chandra Chakravarti—a former Lecturer in the Department of Organic Chemistry, Indian Institute of Science, Bangalore. He was practically bed-ridden since 1934 on account of paralytic attack and was staying in Calcutta. On 20th October 1939, he died of burns caused by an accidental fire in his bed chamber.

Born in June 1897, he was the son of Mr. Chandra Kumar Chakravarti. He took the B.Sc., B.A., M.Sc. and D.Sc. degrees of the Calcutta University with distinction. He was the recipient of a Silver Medal in 1921, Nagarjuna Gold Medal in 1924, and also a Premchand Roychand Scholarship. He was Demonstrator in Chemistry in St. Paul's College, Calcutta, 1920–21, Sir T. N. Palit Research Scholar in the University College of Science, Calcutta, 1921–24, and

Professor of Chemistry, Serampore College, 1925–27. He joined the Indian Institute of Science, Bangalore, as a lecturer in 1927 and held that position till July 1934 when, for reasons of health, he had to resign from service.

Dr. Chakravarti's field of researches comprised both of synthetic chemistry and chemistry of natural products. His papers on the colour of complex diazoles and on sulphur-containing dyestuffs are of great interest. He studied the colouring constituents and the waxy product of the alkannet root and also suggested a constitutional formula for alkannin. His papers on mercaptans and thiophthalic acids deserve special mention.

Dr. Chakravarti was a devoted researcher. But for his ill-health he would have made still more valuable contributions to the science of chemistry.

B. H. IYER.

REVIEWS

Apes, Men and Morons. By Earnest Albert Hooton. (George Allen & Unwin, Ltd., London), 1938. Pp. 307 + viii. Price 10s. 6d.

This is a collection of "reluctant addresses delivered at the instigation of persons or organisations" whose requests the author "dared not refuse". That the progress of man in the past has been bright and that "the tottering biped" is now faced with a dim prospect, is the main thesis of these discourses. While the traditional records of human achievement in the realms of material culture social institutions and human thought are recognised, the biological evolution of man has not kept pace with his other activities. The human improvement required is primarily biological and according to the author, we do not yet know how to effect it. The human race has to be freed from imbeciles and morons who are allowed to reproduce their kind, and to subsist upon the labours of others, from psychopaths who lead the mentally inferior mass of civilised populations into purposeless wars and social revolutions, from the ever increasing numbers of biological and mental inferiors who are antisocial and criminalistic.

The author in one of his addresses has made some "plain statements" about the question of race which has been bolstered up in many parts of the world as an excuse for the domination or persecution of "other" races. Each racial type runs the gamut from idiots and criminals to geniuses and statesman. No type produces a majority of individuals from either end of the scale. There are no racial monopolies of human virtues or vices.

In an address entitled "man as director of human evolution", the author has made specific suggestions concerning the necessity of an intelligent control of man's future evolution through medical science; that auto-directive evolution appears possible for man alone. Studies on human inheritance should be inaugurated since these are essential for man's wise and efficient control of his own evolution. Such studies, according to the author, should commence with genetic researches upon the gross anatomy and general physiology of the human animal, his pathology, his psychology and mental capacity

and should ultimately proceed to his sociability or fitness to function in human society. The future of mankind does not depend upon political or economic theory, nor yet upon measures of social amelioration, but upon the production of better minds in sounder bodies.

This is an extremely interesting book written in a provocative style; it has a topical interest. Humanity is now confronted with a terrible crisis. Political thinkers are planning a reconstruction of human society on lines which will avoid such catastrophies. A study of this volume may give a few important clues as to how this object may be achieved. M. S.

General Physiology. By Philip H. Mitchell. (McGraw-Hill Publishing Co., Ltd., London), 1938. Pp. xviii + 853. Price 36s. 6d.

This is a third edition of the well-known publication, generally employed as a textbook for advanced study and instruction in colleges. The twenty-five chapters which comprise the volume, cover a wide variety of subjects and include illuminating chapters on physiology of contraction, reflexes and tropisms, physico-chemical structure of living matter, the permeability of membranes and living cells, catalysis and enzymes, the circulation of blood, respiration, physiological oxidations, excretion and protein metabolism, dietetics and vitamins, chemical regulation by internal secretions. The series of topics discussed in the volume and enumerated above, at once brings before our minds, the large dependence of physiology upon other fundamental sciences. In fact, the most spectacular achievements in physiology have been made through the application of the principles and the technique of the other sister sciences. Without the sensitive galvanometer, the refinements in spectroscopy, the delicate microbalance and scores of other instruments of precision, physiology would suffer a serious loss. Physiologists have always followed the lead of pure physicists and chemists.

For a true and proper appreciation of the principles and methods of general physiology, a thorough knowledge of the fundamental principles of physics, chemistry and physical chemistry is essential. These principles have

been cleverly woven into the topics under discussion. The chemistry of proteins, fats and carbohydrates, constituents essential to the metabolic activity, has been discussed in a chapter on the organic constituents of living matter. The physico-chemical principles governing surface action and osmotic pressure, have been presented with exceptional clarity and lucidity. The entire volume presents a very readable and interesting series of topics, which should interest not only the students of General Physiology, but also the physicists and chemists, who have the curiosity to understand and appreciate the interaction of fundamental sciences on the growth of general physiology.

M. S.

Atombau und Spektrallinien, Vol. II. By Arnold Sommerfeld. (Fried, Vieweg & Sohn, Braunschweig), 1939. Pp. 820. Price 38 R.M.

This is the second edition of Professor Sommerfeld's well-known volume, which appeared in 1928, namely, the Wave-mechanical Supplement to his *Atomic Structure and Spectral Lines*. The present work is designated Vol. II instead of as a supplement to Vol. I. It has been revised and much enlarged from 352 pages to 820 pages, to include the rapid developments in the subject.

Subjects like uncertainty problems, transformation theory, and the influence of methods of measurement on the results of observations have been treated in Chapter III, only very briefly, as there are several other good books available, such as Heisenberg's *Physical Principles of Quantum Theory*, Dirac's *Quantum Mechanics*, Kramer's *Fundamentals of Quantum Theory*. On the other hand, the author has successfully developed the mathematical apparatus of wave mechanics according to the methods of the theory of functions and of algebra in a simple, lucid and original manner.

Great care has been bestowed on the handling of Dirac's relativistic theory of the electron. It has been given in the hypercomplex units, thereby avoiding the four-rowed matrices of Dirac. In an addenda, however, it has been shown that the Dirac matrices are a possible representation of these units. He has thus removed the difficulty caused by the arbitrariness that lay in the choice of the matrices and in the impossibility of correctly memorising them. Even the Spinor-theory

has been successfully avoided, as shown in Chapter IV, by means of the Lorentz-transformations of the hypercomplex units in place of the Eigenfunctions (characteristic functions).

Problems of importance for experimental observations have been treated in detail. Separate chapters have been devoted to the photo-electric effect, the continuous X-ray spectra and the Compton effect, and in all cases their relativistic refinements have been explained in detail. The method used has been fundamentally treated in the chapter on the theory of perturbations.

The general theory of multiplets has not been taken up apparently for fear of making the book unnecessarily unwieldy. Only the origin of the doublets and their Zeeman-effects, on the Dirac theory have been completely developed. Dirac's theory of radiation and others, like the Briets' equation and Auger-effect, have had to be left out.

The very name of the author is enough commendation for the book. It is a pity that this book which is a result of about six years' labour of this great master has come out this year. Due to war conditions possibly only a few copies may be available outside of Germany.

B. DASANNACHARYA.

An Introduction to the Principles of Physical Chemistry. By O. Maass and E. W. R. Steacie. (New York: John Wiley & Sons; London: Messrs. Chapman & Hall, Ltd.), 1939. Second Edition. Pp. 395. Price 15sh. net.

The book is intended to provide an introductory course in physical chemistry for those who have had a preliminary training in elements of chemistry and physics and who intend either to make chemistry their profession or to take up a course in chemical engineering.

Physical chemistry plays an important role in the understanding of various chemical phenomena both in the laboratory and in industry. It is essential, therefore, that the student should possess an elementary knowledge of the various physico-chemical laws and relationships and have a clear concept of the fundamentals and their applications at a fairly early stage of his study of chemistry. The eighteen chapters in the book cover almost all that is desired to be communicated to a beginner in the

subject. The inclusion of new chapters on atomic structure, phase rule and colloidal chemistry is a decided improvement over the first edition and adds to the comprehensiveness of the book.

The subject-matter has been presented in simple language and as far as possible a good sequence between the theory and experimental work has been maintained. Modern conceptions and developments have been included wherever deemed necessary. Tables and illustrative diagrams have been provided in the text to make the subject easily intelligible. Questions and numerical examples given at the end of each chapter enhance the value of the book to students for whom it is intended.

The book is a good addition to the elementary treatises on Physical Chemistry and will be found useful by undergraduate students of Indian Universities.

MATA PRASAD.

Physical Constants of Hydrocarbons, Vol. 1. By Dr. Gustav Egloff. (American Chemical Society, Monograph Series, New York: Reinhold Publishing Corporation; London: Chapman & Hall, Ltd.), 1939. Pp. 403. Price \$9.00 nett.

The increasing demand for hydrocarbon products has been responsible for the rapid rise of published matter on the subject. A critical digest of all data pertaining to physical constants of hydrocarbons is, therefore, an urgent necessity. This work has been undertaken by Dr. Gustav Egloff, Director of Research, *Universal Oil Products Company*, Chicago, and the first volume of the promised three volumes on the subject is now before us for review. It deals with physical constants of paraffins, olefins, acetylenes and other aliphatic hydrocarbons.

It would have considerably added to the value of this book if special uses and features of the hydrocarbons treated in the book were mentioned in the last column, namely, additional data, which is left blank in most cases. Some of these hydrocarbons can be shown to save special uses, for example, they can, by their presence, increase or decrease the cetene values, the anti-knock properties or the film strength of the oils used in industry. Their presence or absence produces gummy-resin forming tendencies and many other properties.

The get-up of the book is excellent and there are numerous references given at the

end of each chapter. This book will be of particular use to all chemists, who are interested in petroleum products, as a reference book and every technical library should possess a copy of it. S. S. BHATNAGAR.

A Practical Entomological Course for Students of Malariology. By P. J. Barraud. Second Edition; revised by I. M. Puri, *Health Bulletin* No. 18 (Delhi, Manager of Publications.) Pp. 143. Price Rs. 1-12-0.

The study of mosquitoes is becoming more and more complicated year by year and a practical malariologist has to be thoroughly conversant with the details of every one of its numerous aspects, before he can make any headway either in pure investigation or in malaria control. First, he must know how to identify the eggs, larvæ, pupæ and adults of the mosquitoes of his locality. This, to be thorough, requires a detailed knowledge of the minute morphology, especially so when one has to deal with subspecies and races. Secondly, he must be personally familiar with the methods of collection, transportation, rearing and preservation of mosquitoes. Thirdly, he must be well versed in laboratory technique such as rapid methods of dissections of salivary glands and midguts to determine the vector species and of conducting precipitin tests to determine feeding habits. Fourthly, he must have a general idea of the ecology, without which he will not be able to evaluate correctly, for purposes of control, the importance of species, of breeding and resting places, and of parasites and predators. Malariology has developed a rich and intensely practical technique in every one of these branches.

Most medical men who choose malariology for a profession start with very little knowledge of these subjects and even the average general entomologist is not fully aware of the wealth of theory and technique that has grown up in relation to the study of mosquitoes. To both these types of students, the work under review is very useful.

Primarily intended as a handbook for students who attend the annual malaria classes of the *Malaria Institute of India*, it has a great value to others also who may independently take up the study of mosquitoes or who may themselves have to train up other men. The subject-matter is arranged in the form of a series of fifteen lectures,

each lecture being followed by the related practical work, for which copious and pointed instructions are given. At the end of the book is a complete set of illustrations, a list of useful references and, not the least interesting, a full list of equipment needed. In this revised edition, Dr. Puri has brought all information up-to-date. An invaluable book to serve as an introduction to the practical study of mosquitoes.

T. RAMACHANDRA RAO.

The Fundamentals of Fruit Production.

By V. R. Gardner, F. C. Bradford and H. D. Hooker, Jr. Second Edition. (McGraw-Hill Publishing Co., Ltd., New York), 1939. Pp. 788. Price 30/-.

The appearance of the second and enlarged edition of the work of the authors who have been pioneers in the field of pomology, clearly shows that it has met a definite need. In fact, a revised edition was long overdue as since the appearance of the first edition seventeen years ago, the science of fruit growing has made rapid strides. The new edition, therefore, will be doubly welcome to those interested in the fruit industry as also to students, research workers and teachers in Horticulture.

The revised edition like its predecessor is divided into seven sections with chapter headings which respectively discuss (a) water relations; (b) nutrition; (c) temperature relations of fruit plants; (d) pruning; (e) propagation; and (f) geographic influences in fruit production.

The second edition is not a mere re-printing of the first but contains a good deal of extra material. Although no new chapter has been added, it contains numerous valuable additions under sub-heads disseminated throughout the book. This clearly indicates that the subject-matter, in the light of recent researches, has been brought up-to-date. Considering the amazing amount of research, embracing a variety of problems important to fruit industry that has piled up during the last two decades, the task of sifting the published literature for inclusion in the new edition must have been, indeed, formidable. It is to the credit of the authors that the comprehensive nature of the work has made it possible to cover all aspects of the science of fruit growing in the manner they merit.

A noteworthy innovation in the book is the inclusion of a set of useful tables and

figures numbering six and seven respectively. Twenty-seven tables chiefly from Section II, and two figures have been deleted as being unimportant and inappropriate. The addition of fresh information has also necessitated rearrangement of the subject-matter and modification of a few tables and numerous figures. This reshuffling has brought the subject-matter in proper sequence and rendered the interpretation of data clear and lucid. The bibliography at the end of each Section is greatly enlarged particularly in Sections I, II, V and VI. The list of references for collateral reading, on the other hand, is reduced, at the same time a few fresh references are included. In Section VI, however, an altogether fresh list is substituted for the original. The glossary is also enlarged. The addition of fresh matter is so great that the new edition is larger by more than hundred pages.

Of serious errors there are none but a few minor ones have unfortunately escaped the attention of the editors. In many cases chapter heads and sub-heads have not been tabled in the contents in strict accordance with the text. A few sub-heads have altogether been omitted in the table of contents. As in the first edition, the conspicuous omission is the summary at the end of Chapters XI, XXI and XXXII. Further, on page 176 under "Factors of Carbon Assimilation", the factor of "Nutrient Supply" discussed on page 181 is not included. In a few cases the scale of temperature employed has not been indicated against the temperatures—as on page 381 and in tables 38, 57 and 60 on pages 335, 389 and 393 respectively. The spelling of the word "sulphur" is not consistent. On pages 115, 226, 762, 763 and 764, it is spelt as "sulfur" while at many places it is "sulphur".

The list of references for collateral reading ought to have been arranged alphabetically according to the authors and serially numbered to bring it into uniformity with the bibliography which follows.

The book is conspicuous by its absence of references to recent researches on (1) Plant Hormones and (2) Hydroponics—the science of crop production in liquid culture media both of which are now important subjects for research. Particularly, the use of plant hormones—natural or synthetic, is widely advocated in nursery practice. Therefore, it is believed that it would have been within the scope of this useful book to have devoted

a chapter each on the practical application of Plant Hormones and Hydroponics in fruit growing.

The second edition, as a whole, is comprehensive and clearly written and, therefore,

to a practical grower its value is obvious. The student and research worker will also find in it much that is useful.

I. A. SAYED.

The Raman Effect

The Raman Effect and Its Chemical Applications. By James H. Hibben. (American Chemical Society, Monograph Series No. 80. New York: The Reinhold Publishing Corporation; London: Chapman and Hall, Ltd.), 1939. Pp. 544. Price \$11 or 66/-.

DURING the comparatively short period of a little over ten years that has elapsed since the discovery of the Raman effect, a vast amount of literature has grown around the subject. Over two thousand publications have appeared during this period and the subject has been pursued in the research laboratories of practically every nation in the world. A notable feature which characterises this vast literature is the diversity of topics which it covers. The fundamental nature of the discovery and the powerful weapon which its application provides for a study of several scientific problems has undoubtedly been responsible for such a state of affairs. A book writer in this subject is, therefore, confronted with peculiar difficulties. He is not only called upon to critically deal with an incredibly large mass of data but has also to present a comprehensive account of its several applications dealing with apparently very different branches of physical and chemical sciences, if his work is to do justice to the subject.

The book under review is written with special emphasis on the chemical applications by one who has himself done a considerable amount of work in that direction. It consists of three parts, namely, I. A General Discussion of the Raman Effect: Its Practice and its Theory; II. The Raman Spectra of Organic Compounds; and III. The Raman Spectra of Inorganic Compounds. A comprehensive bibliography and an elaborate index are given at the end.

An excellent account of the available experimental methods is given in Part I. The theoretical aspects of the subject with special reference to the normal vibrations of polyatomic molecules are also dealt with in an elementary manner in this Part. The mathematical detail has been skipped over in a number of places and rightly too as the

presentation of such detail would not only have been out of place but would also have unduly increased the size of the book. In the present form, Part I serves as a very useful introduction to a reader who wishes to make a detailed study of these aspects.

Consistent with the title of the book, three quarters of the matter is, however, contained under Parts II and III. In these Parts, the subject of molecular constitution is the dominating feature. Several other aspects such as isomerism of different kinds, free rotation, electrolysis, polymerization, etc., have been adequately dealt with in appropriate places. An alternative arrangement would have been to deal with these important phenomena under separate headings but, as the author himself says, there are certainly several different arrangements possible for the presentation of such a vast amount of material in the chemical field and it is not right to adhere too closely to any one method or criticise too strongly any other. A discussion of the Raman spectrum of benzene in relation to its constitution is contained in Part II. Amongst other notable sections in this part, mention may be made of the one dealing with terpenes and their derivatives. Part III, in particular, contains a full description of the Raman spectra of several simple substances such as some gases, phosphorus, sulphur, carbon, water, inorganic acids, etc., which forms the basis for a thorough understanding and appreciation of the various constitutional problems.

One great point about this book is the fact that it contains an up-to-date and exhaustive collection of experimental results so far obtained in the subject of Raman spectra and hence it is bound to be of immense help as a book of reference to all research workers in this subject. With the help of the bibliography and the index given at the end of the book, references to original papers are easily obtained by one who desires to get more detailed information on any of its particular aspects. As such, it fills up a long-felt void and will be welcome in many quarters.

S. BHAGAVANTAM.

CENTENARIES

Barlow, Edward (1639-1719)

EDWARD BARLOW, a British priest by profession but a mathematician and inventor by nature, was born at Warrington, Lancashire, in December 1639. He had his education at the English college at Lisbon and after being ordained priest, his chief employment was attending the poor "to whom he conformed himself both in dress and diet".

INVENTS REPEATING CLOCKS

Barlow invented repeating clocks in 1676 and repeating watches a few years later. On a string being pulled, clocks were made to indicate the hour or quarter which was last struck. But in a contest with another inventor, Quare, the King preferred to give the patent to the latter.

BARLOW'S VERSATILITY

Barlow had been described as a master of the Latin and Greek languages and as having had a competent knowledge of Hebrew. "Tho' he read not many books of that kind, the whole system of natural causes seemed to be lodged within him from his first use of reason. At his first perusing of Euclid, that author was as easy to him as a newspaper."

HIS WORKS

Barlow was the author of :—

(1) *Meteorological essays concerning the origin of springs, generation of rain, and production of wind; with an essay on the tide*; 1715.

(2) *An exact survey of the tide: explicating its production and propagation, variety and anomaly, in all parts of the world, especially near the coasts of Great Britain and Ireland, etc.*; 1717.

(3) *A treatise on the Eucharist*. 3 v.

The second of these went through a posthumous second edition.

Barlow died in 1719.

Wigan, John (1696-1739)

JOHN WIGAN, a British physician, was born at Kensington, January 31, 1696. He had education successively at Westminster school and Christ Church College, Oxford. He became M.D. in 1727 and a fellow of the College of Physicians in 1732. Having been principal of New Inn Hall, Oxford, and secretary to the Chancellor of the University from 1726 to 1732, Wigan settled in London as physician to Westminster Hospital. He retained this office till 1738 when he went to Jamaica as physician and secretary to Sir Edward Trelawny.

HIS WORKS

As early as 1718 Wigan published a translation of a treatise on the cure of fevers from Longinus's *De Curandis Febris continuis Liber*. In 1723 he brought out a splendid folio edition of Aretaeus. He also edited the *Opera omnia medica* of Dr. Friend in 1733. He also wrote Friend's biography and translated his *History of physick*.

Wigan died in Jamaica, December 5, 1739.

Winchell, Newton Horace (1839-1914)

NEWTON HORACE WINCHELL, an American geologist, was born in Northeast, Dutchess County, New York, December 17, 1839. Having had his early education in the local schools, he became a teacher at the age of sixteen. From 1855 to 1869 he was alternating between studying in the University of Michigan and teaching in schools. Thereafter having been an assistant in two state geological surveys, he finally settled down as the state geologist of Minnesota in 1872 and held the position till 1900 when the survey of the State was finished. From 1874 he also held the professorship of geology in the University of Minnesota. During the last eight years of his life he was in charge of the Department of Archaeology of the Minnesota Historical Society.

HIS WORKS

As state geologist, Winchell published annual reports from 1872 to 1898. These reports, ranging from pamphlets to volumes of five hundred pages, taken along with the ten bulletins and six quartoes published as extra volumes, covered the geology of the State exhaustively. His *Aborigines of Minnesota* (1911) gave a similar exhaustive account of about 10,000 Indian mounds and constituted a regular encyclopædia of the anthropology of Red Indians.

POST-GLACIAL TIME

Winchell's many detailed observations and discoveries relating to the conditions of formation of the drift deposits and the sequence of events in the Ice Age were interpreted with a clearness and logic that have rendered them a substantial contribution to our knowledge of the glacial period. His description and discussion of *The drift deposits of the northwest* in 1873 contained a prophetic pronouncement, which was confirmed by actual field work some twenty years later. He estimated the duration of post-glacial time as lying between 7,000 and 8,000 years. This is regarded as his greatest service to glacial geology.

ANTIQUITY OF MAN IN AMERICA

Winchell's field examination and long deliberation led him to publish in 1902 a memoir of 16 pages establishing that man existed in America in the Ice Age. This subject continued to engage his attention throughout the rest of his life. In fact, his last paper entitled *Antiquity of man in America compared with Europe* was delivered as a lecture before the Iowa Academy of Sciences a week before his death.

GENERAL ACTIVITIES

Winchell was one of the founders of the Minnesota Academy of Sciences and of the geological Society of America of which he became president in 1902. He was also the founder of the *American geologist*, the first geological periodical of America.

Winchell died at Minneapolis, May 2, 1914.

S. R. RANGANATHAN.

University Library,
Madras.

Film Reactions as a New Approach to Biology*

THE colloidal properties of living matter are due to the fact that an exceptionally large fraction both of material and of energy is present in films, membranes, fibres, fine capillaries, and the like. In his presidential address to the Chemistry Section Prof. E. K. Rideal has re-emphasised the importance of the fundamental concepts introduced by Sir William Hardy and Dr. I. Langmuir as to the structure of matter in this boundary state. Many of the modes and types of reactions which can be effected in monolayers, and which can be defined with precision, and their mechanism established with a considerable degree of assurance, are unique for such interphases but are again observed in living and organised material. Many 'vitalistic' models have been proposed in the past, and whilst it might be correct, although unscientific, to suggest that the ultimate level of integration in living matter is incapable of examination and definition, yet one is justified in asserting that at least one of the important levels to which due attention must be given for a proper understanding of biological activities is that of the ordered interface.

Besides the static properties such as form, composition, and orientation, that must be studied, the dynamic properties of ingress and egress of flow and chemical action in and with the two dimensional contents of the phase are particularly significant. From the works of W. Gibbs, Hardy and others, a great deal is known about how the composition of the interphase differs from that of either of the bulk phases in contact with it, as also how the molecules contained in a monolayer are oriented with respect to one another and to the plane of the interphase. However it is to be noted that as compared with monolayers of simple molecules such as derivatives of both paraffinic and cyclic hydrocarbons, the monolayers both of macromolecules as well as those of binary and components of a higher order, possess a number of interesting and somewhat unexpected properties. The chains are extended at the interface and in general, the non-polar side-chains penetrate into one (the non-polar) and the polar side chains into the other (the aqueous) phase. This relative orientation can be altered by extension or compression. If the molecules in the monolayer undergo reaction with a reactant dissolved in the substrate, the rate of reaction may be modified by the change in the molecular orientation of the former. (It is interesting to note in this connection that these film reactions can be carried out with minute concentrations of strongly absorbed reactants, sometimes even as low as 2.5×10^{-6} per cent. as in the case of attack of lecithin by snake venom.) There are also several processes in which an alteration in the properties of an interphase brings about a number of varied

biological processes of great importance such as phenomena of lysis, agglutination, sensitisation, and the lethal activities of certain substances on various types of cells and micro-organisms.

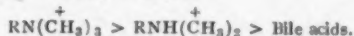
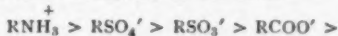
In two component layers the two molecular species are adlineated in respect to one another, and it should be possible to form relatively stable two component complexes which in three dimensions would only be detectable in terms of mutual solubility and which when a mutual solvent is present as a third component might not be observable at all. Indeed strong complexes are formed in mixed monolayers of a variety of substances such as saponin with cholesterol or digitonin or cetyl amine or sulphate with cholesterol.

From the biological point of view the most interesting property of these systems lies in the mechanism of their formation, for on injection of one of the reactants beneath a monolayer of the other, it is found that a penetration of the latter by the former will take place first and then the formation of a complex monolayer by adlineation. Some substances such as digitonin or cetyl sulphate or amine possess remarkable reactivity in respect to penetration of monolayers of cholesterol. Other substances such as sodium oleate, cetyl sulphate, or psychosin, when injected beneath a protein monolayer, disperse it on account of their stronger associating reaction and cause a solution of the protein in the form of a protein-reactant complex.

By spreading monolayers with various head groups and examining reactions caused on injection, it is possible to identify the reacting group in the protein layer. A characteristic group of protein complexes formed in monolayers are the lipo-proteins, such as the gliadin-cholesterol complex. In the latter, the cholesterol is anchored to the specific amino and carboxylic groups in gliadin. These penetrative reactions not only involve a new head group interaction but, in many cases, also a breaking of such a head group interaction already existing in the monolayer prior to penetration. Thus lysis of blood cells can be brought about both by protein and cholesterol, and one must hence conclude that it has a lipo-protein surface.

In the case of reactants containing two or more head groups multiple point contacts are made, and the hydrophobic portions can, if possible, pack or adlineate with its neighbours beneath the monolayer, resulting in a composite film of remarkable stability.

A wide variety of substances have been examined for their extent of interaction with protein monolayers and it has been found that there is a direct parallelism between their extent of interaction and their lethal action on paramoecia. The most reactive group in the protein macro molecule is the amino group, the others following in the order



As regards the hydrophobic portion, biological activity and film penetration commences with

* Summary of the Presidential Address by Prof. E. K. Rideal, M.B.E., F.R.S.—Section B—Chemistry—British Association for the Advancement of Science, Dundee, 1939.

C₈ when attached to a very reactive head group, with C₁₀ when attached to a poorly reactive group, and reaches a maximum value at about C₁₆. It is interesting to note that it is not necessary for all the carbon atoms to be in the form of a chain but may be enclosed in ring systems.

One can see, therefore, that the Overton Meyer or Traube concepts of biological activity, i.e., lipid solubility or capillary activity must be modified by the introduction of concepts of

specific head group interactions. A study of these reactions, further permits us to investigate the nature of the coatings of cells or unicellular animals and plants, by examining the effects of lipid or protein penetrating substances on them.

This extremely interesting address of Prof. Rideal closes with a brief discussion of the possible sources of the bioelectric potentials observed in tissues.

M. A. G. RAU.

MAGNETIC NOTES FOR NOVEMBER 1939

MAGNETIC CONDITIONS.—The magnetic conditions during the month of November 1939 were quieter than those during the previous month. There were 19 days of slight disturbance and 1 day of moderate disturbance. No days of great or very great disturbance were recorded during the month. The number of quiet days was 10.

The quietest day during the month was the 22nd and the most disturbed day, the 13th. The actual characters of individual days is shown in the table below.

Magnetic Storms.—During the month a moderate storm was recorded on the 13th. This was the only storm recorded during the month as against three moderate storms recorded during the corresponding period in 1938.

Dates of the month	Quiet days	Disturbed days	
		Slight	Moderate
1939 November	2 to 8, 10, 16, 22.	1, 9, 11, 12, 14, 15, 17 to 21, 23 to 30.	13

Monthly Characters.—The mean character for the month of November 1939 is 0.70 as against 1.03 for November of last year.

M. R. RANGASWAMI.

Tambyacha Bungla,
Colaba, Bombay 5,
December 6, 1939.

ASTRONOMICAL NOTES

Planets during January 1940.—Mercury will be visible as a morning star for a few days in the beginning of the month and on January 31, will be in superior conjunction with the sun. Venus, moving slowly eastwards relatively to the sun, will continue to be a bright object in the western sky soon after sunset. Mars and Jupiter can be seen to the west of the meridian in the early part of the night. There will be a close conjunction of the two planets on January 7, the angular distance between the two, at the time being about a degree. Mars continues to get fainter, the stellar magnitude being 1.1 (nearly the same as that of Antares) at the end of the month.

Saturn resumes its slow eastward motion among the stars; on January 16, it will be in quadrature with the sun and will still be an interesting object for observation. Uranus has

a retrograde motion in the constellation Aries, until January 26 when it becomes stationary. The planet reaches the meridian at about 7.30 p.m. and can be seen very near the fourth magnitude star δ Arietis. Conjunctions of the moon with planets will occur as follows:—Mars and Jupiter on January 16, Saturn on January 17 and Uranus on January 19.

Comets.—Information has been received (U.A.I. circ. 797) of the re-discovery of Periodic Comet Giacobini-Zinner, on October 15, by Prof. Van Biesbroeck at the Yerkes Observatory. It was a faint diffuse object at the time (magnitude 15), but as it is getting nearer the earth and the sun, it is likely to become bright enough to be seen with moderate optical aid. The comet is due to pass perihelion on 1940 February 17, the computed period being 6.59 years.

T. P. B.

The Interpretation of Plant Structure*

EARLY botanists had to turn their attention to systematic morphology and classification in the first instance. The anatomists were content with describing the facts of internal structure and systematising them.

The "Origin of Species" gave a new impetus for research and the tendency for the interpretation of structure in terms of adaptation to function or of phylogeny became more marked. It is a point for careful consideration whether such exaggerated emphasis on adaptation or phylogeny is justified in the light of modern research.

To take the adaptation outlook first, the structural features of xerophytes are usually regarded as an adaptation for reducing transpiration with little experimental evidence in support of it. Several xeromorphic plants there are which are found to be transpiring vigorously. For a correct interpretation of structure in terms of adaptation it is necessary to have an exact knowledge of the quantitative relations of the different functions to the environment.

So far as quantitative investigations go, the case for adaptation in the case of xerophytes is not very strong. The assumption that xerophytes have fewer stomata is shown by Zelenski to be erroneous. It is found that the leaves of plants growing in dry conditions may show a higher stomatal frequency. Statistical studies of Salisbury show that the proportion of stomata to epidermal cells is more constant over a range of moisture conditions than stomatal frequency which is determined primarily by conditions at the time of the development of the leaf primordium. While the number of stomata is determined by the internal make-up, the frequency of stomata is influenced by the water supply to the leaf in the subsequent phase of expansion during development. The better the water supply to the leaf, the farther apart are the stomata. Hence an interpretation of stomatal distribution in terms of adaptation is not justified.

Another instance of quantitative approach of the problem of adaptation is the correlation between the dimensions of parts and the tissues serving them. A correlation may also be observed between two different organs. An increase in the foliage involves an increase in the amount of conducting tissue. Bower's studies on the relation between scale and complexity are undoubtedly interesting. The functional interpretation of correlations will appear to be far-fetched. Attention should be directed to the study of the casual aspect so that correlations may be correctly interpreted.

The present-day knowledge of chemical agents or hormones such as auxins, throws a flood of light upon the development of plant organs including correlations. One-fifty-millionth of a milligram of auxin produces a measurable effect on the oat coleoptile. The influence of auxins

on the dormancy of lateral buds, the dependence of cambial activity of the stem on the basipetal conduction of auxins from the developing buds above, the change from the vegetative phase to the flowering phase through the diffusion of special substances and so on are facts of no ordinary significance. There are again the organ-forming substances of Went, whose movements are influenced by auxins. "The demonstration that such hormones exist and are effective in influencing plant development is of far-reaching significance. It is a challenge to students of plant structure to view their data dynamically."

Now for the phyletic outlook. It has been the aim of evolutionists to construct a genealogical tree of plants. The phyletic outlook came into prominence as the result of the remarkable studies of paleobotanists. Is similarity always an indication of relationship? In the evolution of plants through ages, several features are commonly observed in a number of unrelated groups of plants. The alternation of generations, the ventilating system of land plants and stomata, the archegonia, the formation of spores in tetrads following reduction division, and the cell structure and organisation are not to be treated as haphazard. Are these resemblances to have phyletic significance? Cannot these features have originated independently in different groups? This similarity or parallelism in the organic world extends also to chemical substances as, for instance, the enzymes in the yeast and higher plants, and the presence of chlorophyll and haemoglobin in plants and animals respectively.

The idea of F. F. Blackman that the biologically important carbohydrates are just those which are chemically most likely to arise can have a wider application. Why should the appearance of chlorophyll or even of living substance be taken to be unique? It is probable that the ground has been prepared for them beforehand through the evolution of a system that could produce chlorophyll, one derived presumably from a pre-existing system capable of producing pyrrol and haem compounds. The nature of the major changes in the pageant of evolution of plants can be better understood if one could have a knowledge of the laws of harmonious development.

The phyletic approach is apt to be misleading. The woodiness of the lower portion of herbaceous plants is regarded as a recapitulation of the presumed phylogenetic sequence in ontogeny. But the fundamental features of the development of stem structure are identical at all levels and the difference that is noticed can be easily explained.

Another instance of phyletic approach of a problem is the interpretation of seedling structure. On the analogy of the stelar structure as revealed by the fern sporeling and the fern stem, one school of botanists holds the view that the seedling structure is a recapitulation of the changes in the structure of the stele. The exarch xylem of the root is seen to extend to the hypocotyl and to even cotyledons in some cases. Can the peculiarities

* Summary of the Presidential Address by Prof. D. Thoday, sc.d.—Section K—Botany—British Association for the Advancement of Science, Dundee, 1939.

noticed in the change from root structure to stem structure in the hypocotyl have a phyletic significance?

An interesting point that has come up for discussion in this connection is the nature of the seedling axis. The phyletic-minded school considers the seedling axis as nothing but a unity of which the root forms a specialised part. But Bugnon has advanced the view that the root and the shoot are two distinct and well-defined categories of plant members each with the power of self-determination.

The power of self-determination of root was demonstrated by means of experiments with root tips cut off from the plant. The tips continued to grow continuously for years in nutritive solutions containing sugar, essential salts and an extract of yeast. The development of the root is normal in the case of tomato, wheat, pea and maize. Kotte found that the tips of roots cut obliquely or longitudinally were able to form complete roots. It is interesting to note that

secondary thickening fails to take place in dicot roots in these experiments.

The shoot is the other self-determining but dominant centre of development. It controls the polarity of the shoot and also the primary and secondary development of the stem below.

"At two ends of a short meristematic axis are two self-determining centres of different kinds in close proximity, two opposite poles, a shoot pole and a root pole, each of which is capable of impressing its own inherent pattern on the meristematic tissues to which it gives rise. Under these conditions we cannot assume that the spheres of influence of each will be sharply defined, nor that they will be necessarily fixed. If the influence of the poles depends upon hormones emanating from them, the boundary might well change with changes in the relative vigour of the two organising centres and differ also from one species to another." The case for the application of recapitulation theory to plants is undoubtedly weak. M. S. S.

Natural Geographic Regions

THE most prominent concept in the British Geographical thought is that of Natural regions. Instead of limiting the term *Natural Region* to physical and inorganic aspects and *Geographic Region* to economic and human aspects, if we define the term *Natural Geographic region* clearly it forms the foundation of all Geographical thoughts. Herbertson's concept of Natural regions reveals the idea to be a conceit rather than a concept; for instead of inquiring where the new concept leads, he contented himself with analogies. His major natural regions were essentially climatic regions. Roxby in 1927 associated the course of human development with natural regions. With this idea is associated the normal conceptions of inevitableness and universality. The French and German Schools of thought converged with the ideas of Herbertson.

Most of the writers delete the word 'Geographical' from the term. According to Roxby a natural region is characterized by a particular set of physical conditions. But in a large area it is hard to find a uniform set of conditions. So, it is better to choose a 'dominant' physical character for larger areas as the criterion. But the view of Herbertson that climates are the 'dominant' characters evoked a lot of criticism. A systematic study is essential before establishing the dominance of physical conditions. The idea that a natural region is a physical entity and that the different regions have no definite boundaries appears to be an unnatural one.

The usual method of regional treatment in orderly succession starting from Geological structure and ending in a description of human matter has no principle of selection and constitutes merely a jumbling of information. Some Geographers insist on the method of

Geographical study by synthesis. Unstead like Herbertson distinguishes orders of Natural region as its immediate environment, because it is a Natural growth limited by geographical circumstances. This is formed from a synthesis of all the countries and is peculiar to Europe. Physical conditions are neither more permanent nor more fundamental in Geography than the 'Human'.

The study of the Natural Geographical regions in this wider sense contributes to the human regions and he assumed that these orders could be further subdivided into 'stows'. Considering 'stows' as physical units, he builds up larger regions; but mere addition of physical units indicates the absence of cohesion in Geographical accounts thereby rendering 'synthesis' an impracticable study.

Synthesis is not merely an addition but is a complex process involving man's relationship with his environment. Hence a Natural Geographical region is a result of Synthesis proceeding in nature under our eyes but not by our voluntary action. The synthetic product has two aspects, viz., the Environmental aspect, and the Human or Functional aspect. The first constitutes the Region and the second the Community. Hence, the term 'Natural Geographical region' must take both into account; if not it ceases to be Geographical.

The unity of the Natural Geographical region is achieved, maintained and developed by organisation, and this cohesion is attained and extended by intercourse, at first within, and later beyond the region, provided the 'organic development is an indigenous growth. There are minimum and maximum sizes for natural regions. The minimum is determined by the least extensive area capable of being developed and organised. The maximum is determined by the efficiency and range of means of communication. Both these vary in time. The organisations could be classified as 'conscious' and 'self conscious' depending on the objective view of man and its source in his nature. Natural

* Summary of the Presidential Address by Mr. A. Stevens—Section E—Geography—British Association for the Advancement of Science, Dundee, 1939.

regions could be distinguished as of continuous and discontinuous development depending upon the changes in human life.

What is fundamental in consideration is not the difference of Topographic fragmentation but the relativity to man. By this conception, it is seen that the Natural Geographical region is an active organism which is controlled by the technical development of the people and the means of communication.

The European Nation-State is an organic phenomenon occupying a Natural Geographic well-being. For the development of Geography, the consideration of Historical Geography is important. The territorial developments of European States culminated before the War, but are now readjusting. From a study of living Geographical entities, the Geographer can offer suggestions on practical politics and help the development of National future. B. V.

Metamorphism and Igneous Action*

IN 1833, Lyell introduced the term "Metamorphism" to indicate rock transformation and, from the beginning, he considered that metamorphism was closely connected with some kind of igneous activity. In the development of ideas on metamorphism since Lyell's time, emphasis has been laid upon the dominance of one physical factor or other in rock transformation as seen in expressions dynamic metamorphism and thermal metamorphism; or on spatial considerations as in regional or local metamorphism. The term "metamorphism" is extended by some to include weathering and cementation; and contracted by others to exclude simple crushing. Recrystallisation is regarded as an essential in metamorphism by one school, and as not requisite by another. According to one group of geologists the chemical composition of rocks undergoing metamorphism is not changed; and according to another it can change to any extent.

This diversity of opinion is due to certain fundamental and human causes. It arises mostly from a generalisation of ideas based on experiences confined to limited regions, to cover the whole field of metamorphism. Localised experiences from several regions led to different schools of thought which were, more or less, nationalistic in character. The following brief review of the tenets held by these different national schools will indicate the lines of development of metamorphic geology.

In Germany, Rosenbusch, from his study of contact metamorphism around the Barr-Andlau granite, in 1877, found no evidence for transfer of material from the intrusive granite into the surrounding country; and applied his conclusion from that study to all granitic contacts, laying down that permeation by magmatic juices was impossible. Lehmann (1884) and others from their study of gneissic rocks held the view that gneisses were formed by movement, and termed this mode of alteration "dislocation metamorphism", which was called later by Rosenbusch, dynamic metamorphism. Therefore for the older German School of geologists, there were two kinds of metamorphism—contact metamorphism of a local character surrounding igneous intrusions, and dynamic metamorphism extending over very large areas resulting from pressure consequent on earth movements.

Some of the German geologists, however, during the first decade of the present century, described many examples of transference of material, and cases of injection and assimilation at granitic contacts.

In France, a powerful school had developed with tenets completely opposed to those of Rosenbusch. From their studies, during 1880-1900, of different granitic contacts, the French School of geologists concluded that the country rocks adjacent to the advancing magma had been changed in chemical composition by mineralising agents and granitised. The original granite magma combined with the country rock either by permeation or by *lit-par-lit* injection; and it advanced by the conversion of its country rock into granitic material and incorporating it in the main moving magma. Granitisation or feldspathisation was established, by this School, as a petrogenetic process.

Many of the products of these injections and granitisation processes were foliated or gneissose in structure. According to the French School, therefore, gneisses were not the result of a dynamic metamorphism as the German geologists believed, but resulted from the injection of magmatic material.

Termier, however, though a bitter opponent of dynamic metamorphism, expressed his views on the processes of metamorphism somewhat different to those of his countrymen. According to him, the causative factor of metamorphism was the coming from depths of juvenile liquids, when the temperature of the geo-synclinal sediments increased rapidly leading to the solution of the eutectic mixtures. True magmas were formed, here and there, of all dimensions, increasing with the depth; in the upper parts, the geo-synclinal sediments were recrystallised without any change of chemical composition and passed downwards into gneisses, and upwards and laterally into less metamorphic rocks; the still liquid "magmatic portion" was intruded at higher levels in cross-cutting form. Therefore, according to him, regional metamorphism was not caused by igneous intrusion. Both regional metamorphism and igneous intrusion occurred together as different effects of the same cause—the rise of the *Colonnes filtrantes* or juvenile liquids.

In Austria and Switzerland, the study of metamorphic rocks led to the elaboration of ideas relating to directed pressure and the influence of depth factor in metamorphism. This School of geologists hold that due to difference in temperature, pressure and such other physical

* Summary of the Presidential Address by Prof. H. H. Read, D.Sc., F.R.S.—Section C—Geology—British Association for the Advancement of Science, Dundee, 1939.

factors in vertical column of depth, groups of minerals of varying physical characters are produced, by metamorphism, in different zones. The classification of such zones and the groups of minerals which would be formed in each of them have been the subjects of elaborate study by Becke of Vienna, Heim, Grubenmann and Niggli of Zurich.

In Scandinavia, important contributions were being made to the study of metamorphism. Sederholm, in Finland, by a series of extended investigations on several granitic contacts expressed his views that the granitic magma by processes of penetration and injection, in which the magmatic juices or *ichors* played a large part, mixed with the country rocks to give rise to a great variety of composite or mixed rocks, —the migmatites. Re-fusion or re-resolution was effected by emanations from abyssal magma, giving rise to secondary magmas capable of intruding into their surrounding rocks. In America, up to the period of the Great World War, two schools of thought had developed; the one led by Lindgren and other mining geologists demonstrating transfer of material at igneous contacts, and the other dealing with injection metamorphism and granitisation after the manner of the Scandinavian and French schools.

In Britain, Judd (1889) proposed his term "static metamorphism" to cover those changes resulting from pressure due to the weight of superincumbent load, and not to movements in rock mass. This idea was elaborated by various geologists in Europe and America. Horne, Greenly, Barrow and several others have examined the metamorphic areas and described the processes and effects resulting from granitic intrusions.

There is no uniformity in the classification and definition of rock transformations. For instance, one dichotomy is based on space, as in regional and local metamorphism, another on mechanics as in static and dynamic metamorphism, a third on geological considerations as in Grundgebirge and Deckgebirge metamorphism and so forth.

Regional metamorphism, meaning rock transformation affecting over extensive areas, has been ascribed to different processes. Some geologists require that regionally metamorphosed rocks should arise by the action of hot emanations on deeply buried rocks; and others including Rosenbusch, Holmquist, and Teall and Flett of the British school, use that term as equivalent to dynamic metamorphism; Harker considers that the essential of regional metamorphism is a conjunction of high temperature and intense shearing; and still others such as Giekie, Kemp and Clarke maintain that the definition should state clearly that the transformation was not connected with igneous activity.

Prof. Read interpreting "regional metamorphism" in its real sense, to mean "a transformation that has affected large portions of the earth's crust" discusses his views on the processes which have brought such transformation.

He considers that the effects of dynamic metamorphism in producing rock transformation on a large scale has been exaggerated. The idea of higher grade metamorphism being produced under enormous load is also negated. From evidences found in several regions showing the preservation of original rock structures such as current bedding, graded bedding, varved bedding, etc., in completely recrystallised sediments and the obliteration of such structures in low grade metamorphosed rocks it is argued that there is no need to assume great depths for regional metamorphism. On the contrary, Prof. Read considers that high grade regionally metamorphosed rocks must have been formed in many areas under relatively little cover.

Prof. Read discusses in the later part of the address the various aspects of granitisation, —the sequence of the processes of replacement, introduction of magmatic material, migmatitisation, metasomatism and the formation of "parts" of chemical individuality, etc. He is inclined to divide all rock transformations into two groups; one, those of dislocation metamorphism associated with dislocation of the crust, and the other, those of regional and thermal metamorphism associated with igneous activities.

World's Most Powerful Magnet

THE Institute of Physical Problems, in Moscow, possesses the most powerful magnet in the world.

For obtaining superstrong magnetic fields, Prof. P. L. Kapitza employs a solenoid, through which a strong current passes for a few hundredths part of a second. At this instant a superstrong magnetic field arises in the solenoid which due to the shortness of the time does not become warm. Kapitza worked out a special type of storage battery for his first experiments; it could be charged in the course of a few minutes and then short-circuited through the solenoid. At the moment of the short circuit, a current up to 7,000 amperes could be obtained, producing a magnetic field up to 80,000 gauss.

Later, Kapitza replaced the storage batteries by a powerful alternating current generator. His rotor revolves at a speed of 2,000 r.p.m. The slacking up, which takes place during an infinitesimal fraction of a second produces a shock like a miniature earthquake.

In the beginning, Kapitza was confronted by great difficulties arising in connection with the construction of the coil of solenoid. During a short circuit, tremendous radial forces would arise in the coil and break it. Kapitza turned to theoretical calculations and worked out a satisfactory design for the coil. With its use, it has now been possible to induce magnetic fields of a force as yet not attained anywhere else in the world—325,000 gauss. (*Sovietland*, 1939, 8, 18.)

SCIENCE NOTES AND NEWS

Chief Racial Types of India.—Thirty bronze heads, representing the chief racial types found in India, have been purchased by the Government of India, for the Ethnographical Gallery of the *Indian Museum*, Calcutta, from Mrs. Marguerite Milward, a distinguished sculptress and pupil of Bourdelle.

The figures, which enable visitors to form a correct picture of the main races of India, have for the present been placed in the western end of the Gallery, but will shortly be displayed on pedestals where they will get full advantage of light and provide an additional attraction.

The sculptured heads are made from living individuals selected for Mrs. Milward by anthropologists and local officers belonging to the Government of India and the Indian States, who are intimately acquainted with the different tribes and know their peculiar somatic features.

Besides being works of high artistic excellence, the heads are illustrative of the somatic peculiarities of the different tribes with an exactitude of details which it is difficult to surpass. Among these there are the busts of a Negrito Kadar with his frizzly Melanesian hair, fair representatives of the Proto-Australoid group such as the Santals, Mundas, Maria Gonds and the Chenchus of Hyderabad, representatives of the Mongoloid tribes of the sub-Himalayan region and Assam, such as the Tibetan and the Lepcha of Sikkim, the Abor and the Mishmi from the extreme northern frontiers of Assam and the Angami and the Konyak Nagas of the Naga Hills. The busts also include the head of a Toda of the Nilgiri Hills and a Bengali Brahmin of a well-known family of Calcutta.

Oxides of the Transition Metals.—Among the several interesting properties of the transition metals and their salts, the non-stoichiometric decomposition of their oxides (i.e., Mn and Cr) presents an intriguing problem. The magnetic properties of these compounds provide a convenient method of study, but show such wide variations in the case of the oxides that not much progress has been possible in this direction. Bhatnagar, King and co-workers (*J.C.S.*, 1939, 1433) have now successfully tackled this question by showing that by the application of Weiss's modification of the Curie Law, values are obtained for the magnetic moments of the oxides of chromium and manganese which are in accord with theory and enable magnetic measurements to be used for the evaluation of the correct formulæ of oxides. The occurrence of quadrivalent chromium as a hydrated dioxide, $\text{CrO}_2 \cdot \text{H}_2\text{O}$, first reported by Bhatnagar *et al* (*J.C.S.*, 1938, 1428) is now further confirmed. Samples of chromic oxide prepared by different methods have slightly varying susceptibility values. It is suggested that these differences are due to the presence of impurities and, in particular, to small amounts of chemisorbed gaseous elements. The magnetic susceptibility

of the various stages of decomposition of chromium trioxide has also been measured, and it has been found that there is little change in the magnetic susceptibility with variation of composition in non-stoichiometric oxides.

M. A. G.

Solubility of Lead Sulphate in Solutions of Sulphuric Acid Determined by Dithizone with a Photronic Cell.—Norman Craig and George W. Vinal (*National Bureau of Standards*, 1939, Research Paper, R.P. 1165) have determined the solubility of lead sulphate in sulphuric acid solutions of concentrations comparable with those used in lead storage battery. The determinations were made at two temperatures, namely, 25° and 0° C. The results obtained are given in detail.

The method consisted in the addition of diphenylthiocarbazone reagent to the solution containing lead and comparing the colour developed with that generated in a solution containing known quantities of lead. The equivalence point was detected by an arrangement of a photronic cell and colour filter.

The saturation equilibrium was arrived at from both sides, viz., undersaturation as well as supersaturation. The average error of the determinations is reported to be 0.7 microgram.

K. R. K.

Determination of the pH Value of Papers.—Herbert F. Launer (*National Bureau of Standards*, 1939, Research Paper, R.P. 1205) has suggested a simple and rapid procedure for determining the pH value of papers. The factors studied included cold and hot extraction, time, and preliminary reaction of the water used for extraction. Grinding the paper was found to be unnecessary, but in the case of thick "Kraft" papers the time of extraction had to be prolonged for 20 hours.

The procedure recommended by the author is briefly as follows: 1 g. of air-dry paper is macerated at room temperature with distilled water (pH 5.9-7.0) and allowed to stand 1 hour in the case of ordinary paper and for 20 hours for thick and dense paper. The pH of the unfiltered mixture is measured with a glass electrode. Duplicate determinations agree within 0.1 pH. The relationship between the pH values and the stabilities of the papers is also briefly discussed.

K. R. K.

Leeches of the Dal Lake, Kashmir.—Unfortunately, the study of the group of animals comprising the leeches has not engaged the attention of Indian zoologists till now, and therefore, we welcome this interesting account of the Kashmir Hirudinea all the more. M. L. Bhatia (*Bull. Dept. Zoology, Punjab Univ.*, 2, 1939) records the occurrence of four genera of leeches from the Dal Lake. The genera *Glossiphonia* (= *Clepsine*), *Theromyzon* and *Hemiclepsis* belong to the family *Glossiphoniidae* while the

arhynchobdellid Erpobdella comes under Erpobdellidae. A new species has been added under Theromyzon, *T. matthaii* which closely resembles the Siberian *T. garjewi*. Thus, we have two species of Indian Theromyzon, *T. seroculata* Moore and *T. matthaii* Bhatia. In the latter species the middle of the body shows three annuli; the intestine has four pairs of caeca and the crop eleven pairs.

How They Grow Cotton in Egypt—A Comparison and Contrast.—Dr. Frank Crowther, the well-known authority on cotton cultivation in Egypt, who made a prolonged tour of about nine months in India, visiting the main cotton areas and inspecting the experiment stations engaged in cotton experimental work in this country, has now published his impressions which are both valuable and interesting (*Agr. & Livestock in India*, Vol. IX, No. 4). The most important contrast is in the yield of cotton; thus while in Egypt, it is 464 lbs. of lint per acre, irrigated cotton in the Punjab, Sind and Madras yields only at the rate of 135, 218 and 250 lbs. of lint respectively. Cotton land in Egypt often pays a rental of Rs. 100 to Rs. 120 an acre, and this breath-taking sum, in addition to water rates and other taxes—a truly staggering contrast with rents and taxes here. Cotton in Egypt is grown on good clayey soils under irrigation; in India clay land of the usual black cotton type, is deemed unfit for growing cotton under irrigation. Cotton in Egypt is heavily manured with artificial manures, principally nitrogenous; very heavy dressings amounting to as much as 600 lbs. of manure (93 lbs. of nitrogen) per acre are said to be common in Upper Egypt. The high yields are the result mainly of this heavy manuring, for the Egyptian soil is not inherently very rich nor is the Nile silt which is often acclaimed as the creator of Egypt's fertility any richer than the soil itself and can obviously therefore have little effect in raising the soil nitrogen supply. The trend in India in recent years to look with disfavour on the use of artificial manures is inexplicable to the visitor who feels that there is not enough experimental evidence to support this attitude. Indeed if Egyptian experience is any guide the need is all for a large use of such manures even though they may not be supplemented by much farmyard manure, without any fear of soil deterioration. The desirability of utilising clay soils for irrigated cotton is commended, and some ameliorative methods for getting over the drawbacks feared, which have led to the prevalent opinion against these soils, are suggested; these are, what is called, "sand-sowing" to correct faulty germination, and a rotation with a long fallow. In view of the possibilities of a successful application of these methods it is essential that these methods should be carefully tested. We should have greatly appreciated the visitor's views on the main trouble with irrigated cottons and indeed with all the American cottons grown in India, viz., the leaf reddening and shedding of bolls and leaves which affect this cotton whether it is irrigated or grown dry, and which, notwithstanding investigations so far, have not been prevented. So great is the ravage and so hope-

less the situation that it has even given rise to the opinion that India is unfitted for American cotton and should grow only Asiatic cottons. Lack of drainage is suggested as one probable cause but the trouble is common even where there can be no possibility of poor drainage. We also fear that sufficient note has not been taken of the significance of varietal characteristics, especially such as are due to the differing root systems, in interpreting Egyptian results for application in India. As regards dry or rain-fed cotton, an extension of the practice of bunding the fields across the lower contours which is now common in some parts of the black cotton soil tracts is commended. The crop failures frequent in the Ceded Districts cotton tracts have puzzled the visitor who says that in the Sudan which has a much smaller rainfall such failures are unknown. Earlier maturing jowars are suggested for the tract as a food crop; some of the common jowars of the Sudan are said to be earlier maturing and are recommended for trial.

The need for putting down experimental plots on ryots' holdings and for the use on a larger scale of the method of combining several factors in one scheme in the experimental plots on the Experiment Stations themselves are other matters stressed. The somewhat strong views expressed in favour of the use of artificial manures in India against the present attitude of certain workers is in our opinion a distinct service to the cause of increased crop production in India. A. K. Y.

Borer Pests in Forests.—Details are given in a recent number of the *Indian Forest Records (New Series)* on Entomology, just brought out by the Forest Research Institute, Dehra Dun, of 15 new species of *Cerambycidae*, a family of forest insects popularly known as long-horn beetles, occurring in India.

The larvæ of the *Cerambycidae* are borers. Some species are found in living trees, some in dead wood and a few in herbaceous stems. The family includes many of the most harmful forest pests. A study of these insects is therefore of great importance to forestry.

The biology of over 300 species of *Cerambycidae* attacking some 600 different kinds of trees has been studied at the Dehra Dun Institute.

Flying Fish.—To the many valuable exhibits which the *Zoological Survey of India* have placed in the Fish Gallery of the Indian Museum, Calcutta, an addition has lately been made in a pictorial exhibit illustrating the flight of fish in air. These aerial excursions of the Flying-fish are made possible by their greatly enlarged pectoral fins which sometimes extend as far back as the tail, and are undertaken primarily in self-defence. The flight in fish is quite unlike that of birds, inasmuch as there is no actual movement of the "wings" (pectoral fins), which are held rigid and act like the planes of a "glider".

When about to undertake a flight, the fish accelerates its speed, and rushes along near the surface of the water moving its tail rapidly from side to side. Then it takes a sudden leap out of the sea and is borne along through air

with the pectoral fins outstretched and practically motionless. The chief motive power is supplied by the tail in the initial stages of the flight.

Recent investigations reveal that the duration of flights in fish rarely exceeds 30 seconds and that the comparatively longer flights extend from 200 to 400 metres; the average speed under favourable conditions ranges from 10 to 20 metres a second. As a rule the flights are close to the surface of the sea, but not infrequently fish are carried to a height of 15 or 20 feet by currents of air.

Money and Banking, 1938-39.—The two volumes recently issued by the League of Nations (Geneva, 1939, pp. 58, price 1/-) are a continuation of the memoranda on *Commercial Banks* issued in 1931, 1934 and 1935, and of *Money and Banking* issued yearly since 1935. They are publications of the *League of Nations* which, whatever its prestige in the political field, maintains the highest degree of thoroughness in economic intelligence service, and these two books will remain like their predecessors the repository of accurate, authoritative and impartial information for the economist, financier and politician of whatever nationality and school of thought. Without going into details of the course of events in banking houses and Chancellories of the Exchequer in the several countries of the world, it will probably suffice to know that, owing to the play of two sets of factors, 1938 was an eventful year in the field of foreign exchanges that witnessed serious disturbances in international exchange relationships. On one side, political developments led to precipitate transfers of capital funds from one currency into another while, again, fall in the prices of primary commodities imposed severe pressure upon the balance of payments of agricultural debtor countries. It is also of interest to learn that in the earlier part of 1938, it was the continued depreciation of the French franc that attracted much attention, whereas, in the second half of the year, it was the decline in the gold value of the pound sterling which constituted the outstanding development in international monetary relations.

K. B. MADHAVA.

Imperial Dairy Institute, Bangalore.—The *Annual Report of the Imperial Dairy Expert* for the year ending June 1938 (Manager of Publications, Delhi, 1939. 53 Pages, 19 photographs and 3 diagrams) describes the advisory work of the Imperial Dairy Expert and the research, educational, dairy and dairy husbandry activities of the Imperial Dairy Institute, Bangalore, and the Wellington Milk Depot in the Nilgiris. What deserves strong comment is that a report covering a 12-month period should take another 16 months to produce. The report has been carefully prepared and is generously illustrated, which enhances its educational value.

The Imperial Dairy Expert answered 142 enquiries, of which 28 were minor questions regarding dairy literature; the gross cost of answering each major enquiry amounted to

Rs. 340. Most of the enquiries dealt with dairy husbandry, management and technology.

Particulars of the progress made in building up the herds of Sindhi and Gir cows and Murrah buffaloes are given; a slight rise in average yield was shown. Live weight increases in cows during the gestation period, and the growth rates of calves up to two years of age were determined but no figures are reported. A large number of analyses of milk was done; it would have been of considerable value to have included a simple statistical analysis of the results, if only as a distribution table. The testing of a milking machine gave unsatisfactory results. Care of the pipelines and efficient cleaning of the machine parts with detergent solution, assembly and steaming, should produce good results.

The subjects described on page 10 *et seq.*, are not "Dairy Husbandry Investigations", but "Milk Handling and Milk Products". Fermentative changes in milk have been studied in preparing butter cultures, the making of Surati cheese and lactic casein. Some attention has been paid to the conditions in ghee-making which contribute to the properties used in judging ghee quality, *e.g.*, flavour and texture. The findings show that a considerable amount of extra work is needed to explain crystallisation behaviour during the cooling of ghee. The making of ghee direct from cream has been studied; it is to be feared that the yields from such a method may be unsatisfactory owing to the physical nature of cream. Care in the washing of lactic casein and its drying in the shade give a product of good quality. These caseins could profitably be qualified further by a chemical analysis giving figures for fat and ash content.

Other investigations on milk secretion, detergents and dairy plant are referred to. It would be profitable to readers of this report were they to be provided with a fuller description of the results of the items of research and not to have to refer to papers published at some future, and perhaps distant, date.

Five papers were published by the Department, some in collaboration with the Indian Institute of Science. Here, again, a summary or abstract of each paper would be of value.

The rest of the Report gives the working of the farms, laboratories and dairies from the educational and administrative standpoint. It is interesting to note that although the Institute at Bangalore spent Rs. 1.346 lakhs per annum, it received Rs. 0.744 lakhs in return for produce sold, while the Wellington Milk Depot made a profit of Rs. 450 on an annual expenditure of Rs. 43,000.

W. L. DAVIES.

Mysore Geological Department.—The recent issue (Vol. 37) of the *Records of the Mysore Geological Department* contains as many as 10 papers, embodying the work done by the officers of the Department during the year 1937-38, in addition to the General Administrative Report for the year by the Director. Some of these papers are of purely scientific interest and are the result of detailed mineralogical and petrological investigations; others deal with the more

useful economic aspects bearing on the existing or possible mineral industries of the State. An interesting contribution is the "Report on the marks of weathering on the statue of Gomateswara at Sravanabelagola, Hassan Dt.," dealing with the possible methods of warding off the further effects of this weathering and thus help to "pass on to posterity this magnificent piece of monolithic sculpture through ages to come".

Spectrographic Analysis.—We have received from Messrs. Adam Hilger, Ltd., two publications: (1) "Spectrographic Analysis in Great Britain," edited by A. C. Candler, and (2) "Absorption Spectrophotometry and its Applications: Bibliography and Abstracts 1932 to 1938" by O. J. Walker. The former is a compilation of contributions from a variety of industrial and analytical Laboratories in Great Britain and indicates vividly how widely modern spectrographic methods are in use, although but few technical publications are to be seen in the literature. The articles cover a wide range of subjects from alloy steels and lead sheet to agriculture and archaeology, and have been arranged roughly under four heads: (1) Metallurgy, (2) Glasses, Paints and Fabrics, (3) Soils and Plants, and (4) Art, Archaeology and Crime. The study of the brochure brings out why the spectrograph has been preferred to alternative methods of analysis: in some cases, as in routine control it is the quickest, in others, small traces may be more reliably estimated, and yet in some others analysis can be done with the very small quantities alone available.

The second is a timely publication which brings up-to-date the bibliography on Absorption Spectrophotometry. This optical technic is of practical assistance in many kinds of problems including qualitative and quantitative analysis, detection and measurement of chemical and physical changes, determination of the structure of molecules and materials, and colour analysis and measurement. By rewording the titles where required, and by providing short abstracts, a good guide has been given to the contents of the papers. They are all classified into 3 parts, the first dealing with applications to analytical and industrial problems, the second with applications to biochemistry and physiology, and the third with papers containing quantitative spectrophotometric data. An additional part IV is formed of the author index.

Brown Trout, *Salmo trutta fario* Linn., in Himalayan Streams.—A plea for a thorough biological investigation of the waters of the streams before introducing any exotic species is made in a paper which Dr. Gulam Mustafa Malik read at a meeting of the *Royal Asiatic Society of Bengal*, held on 4th December. The author drew attention to Mitchell's observations regarding the destruction of the Mountain Barbels of the genus *Oreinus* from the Kashmir trout-streams in relation to the growth of Brown Trout. Analysis of the gut contents of 131 specimens of *Oreinus* from Chitral, Kagan Sub-division of the Hazara District, and Afghanistan was reported. "Brown Trout, a carnivorous fish, flourishes well in association with *Oreinus*, as the latter keeps the streams clean

of the vegetable growth and other deleterious matter and thereby encourages the growth of insect larvæ that inhabit rocks and stones and form the food of Brown Trout. Further, its fry provide food for the trout during the season when insects which form its normal diet are scarce."

In a second paper, the same author discussed the case of mortality of the Brown Trout in the Jabori and Shinu hatcheries of the Hazara District, N.W.F. Province. "In the case of Jabori hatchery the mortality can be traced to excessive growth of algae and to the development of thyroid tumours or goitre. The death of trout in Shinu hatchery can be attributed to malstripping and malnutrition." The author described an interesting case of visceral abnormality. This study has led the author to conclude "that some of the deaths at least could be prevented by the employment of better trained staff for manipulation during stripping and by feeding the fish on a suitable diet."

The Health Organisation of the League of Nations.—Although due to the present crisis in Europe the meetings and other activities of the Health Organisation that had been planned for September and October had to be postponed, the regular and permanent work of the Section has proceeded unimpeded. The Epidemiological Intelligence Service and the Singapore Bureau have continued to collect and distribute the information in the usual manner. "The work of the International biological standardisation, the preparatory studies for the unification of the pharmacopoeia, the enquiries into anti-rabic vaccination and radiotherapy of cancer of the cervix uteri and the investigations into nutrition which are now proceeding in the Far East under the auspices of the Health Organisation will continue unhampered", according to a report contained in the latest number of the *Chronicle of the Health Organisation*.

In September, Professor Edmond Sergent wrote to say that the Pasteur Institute of Algeria is continuing, as in the past, experiments on the use of synthetic anti-malarial drugs, its trial tests with controlled vaccination against typhus fever, its work on B.C.G. and the preparation, in association with Sir Rickard Christophers, of a text-book for the unification of malaria terminology. Many other assurances of continued support have been sent to the Health Section by various health administrations, experts and scientific institutes. The aim, in Professor Sergent's own words, is for "all men of goodwill to rally to the support of the Health Organisation in an effort to assert the pre-eminence of intellectual work as a means of promoting the welfare of all".

"In the course of his tour, the Director of the Health Section found that the European Balkan countries directly or indirectly concerned were, in principle, favourable to concerted action under the auspices of the Health Organisation. From many other parts of the World, the Section has received encouragement and offers for help, which will certainly prove valuable if circumstances should call for action. Measures have already been taken to help the Roumanian Health Administration to procure the extra

stores and equipment that are required for the prevention of typhus fever."

The Faraday Society recently held their 33rd Annual General Meeting at Cambridge. Scientists the world over are aware of the outstanding position in the Society's activities achieved by their "General Discussions" which have been organised in recent years at the rate of two per year. These "Discussions" were inaugurated during the tenure of the office of Secretary by the late Mr. F. S. Spiers. The annual lectures delivered in memory of Mr. Spiers by distinguished scientists will in future take the form of an Introductory Lecture at such General Discussions of the Society. The Society has about 850 members on the roll, and besides publishing its own *Transactions* in the usual twelve monthly parts, works in co-operation with the *American Chemical Society* in the production of the *Journal of Physical Chemistry*. The Society accepts for publication suitable papers submitted by authors who are not members, but authors who are members will receive free reprints of their papers.

University of Mysore.—I. Meeting of the Senate: (a) A Special Meeting of the Senate was held on the 17th November 1939, for awarding the Diplomas of candidates successful at the First L.M.P. Examinations of 1939, the Vice-Chancellor presiding.

(b) The ordinary meeting of the Senate for the year was held on the 17th November 1939.

(i) Among the propositions that were passed, mention may be made of the following:—

- (1) Revised scale of fees for the M.B.B.S. course, consequent upon the institution of a Second Examination for the Final M.B.B.S. in June.
- (2) Course of Studies in Chemical Engineering.
- (3) Course of study and scheme of examination in French and in Latin for the Intermediate Examination.
- (4) Revised syllabus in modern Physics.
- (5) Detailed course of studies for the B.T. Degree examination.
- (6) Institution of Geography as an optional subject of study for the Intermediate and Degree courses.

(ii) The following recommendations were made to the University Council by the Senate at the above meeting:—(1) Appointment of suitable Muslim graduates as Assistant Professors and Professors in all the departments of the University. (2) Enhancement of the number of free-studentships awarded to Muslim students. (3) Introduction of 'Islamic Culture and Civilisation' as one of the optional subjects in the Arts colleges. (4) Grant of conveyance charges to such of the purdah observing lady students as have not been granted any scholarships. (5) Establishment of a 'University Institute of Industrial Research' under the auspices of the University.

II. University Extension Lectures: The following lectures were delivered:—(1) Mr. L. M. Schiff, M.A. (Oxon.), Cawnpore, on 'India and the Modern Cult of Nationalism' at Bangalore and on 'The Truth about the Race Myth' at Mysore. (2) Dr. C. N. Srinivasengar, D.Sc., Professor of Mathematics, College of Engineering, Bangalore, on 'The Solar System' in Kannada, at Channarayana and Malavalli. (3)

Mr. K. B. Madhava, M.A., F.R.A.S., A.I.A., Professor of Mathematical Economics and Statistics, Maharaja's College, Mysore, on 'Some Problems of Forthcoming Population Census' in Kannada, at Tumkur and Madhugiri. (4) Mr. L. Rama Rao, M.A., F.G.S., Professor of Geology, Central College, Bangalore, on 'The Mountains of India' in Kannada, at Mysore.

Viscount Nuffield and Mr. John Davison Rockefeller have been elected Fellows of the Royal Society under the terms of the Statute which provides for the election of persons who "either have rendered conspicuous service to the cause of science, or are such that their election would be of signal service to the Society".

Industrial Notes

Hot Spraying of Shellac.—There have been instances in industry when a small improvement in the technique of application of a slight deviation in processing, has led to a phenomenal increase in the employment of the product in industries. The process of hot spraying which has been developed by the London Shellac Research Bureau, is one which has such potentialities and should, therefore, be further developed, extended and perfected with all possible speed. The method which is described in their Bulletin No. 5, October 1939, consists in using pulverised shellac and causing the powder to fuse by passage through a flame. The fused particles are projected on to a surface to form a well-bonded coat. The Bulletin describes the various means tried for securing a steady supply of the pulverised material to the flame, as also the development of a simple apparatus for effectively carrying out the process. A study of the operating conditions has been made. Present and potential fields of application are indicated.

We wish to congratulate the authors on this important contribution to the Indian Lac Industry.

Recent Researches on Lac.—Increasing contacts with lac-consuming industries have enabled the London Shellac Research Bureau to understand their problems and help in their solution. Among the many commercial preparations connected with lac products in which the Bureau has been engaged, is the development in the use of lac oil varnishes, used for lacquering tin food containers.

Quick drying paints of high gloss and flexibility are also being developed. Experiments are in progress to produce a quick-drying plastic paint which can be applied to rubber surfaces by brush or spray.

Highly elastic materials are now being made by polymerising modified lacs. Such products have shown high electrical resistance. If other mechanical results are satisfactory large quantities would be used for insulating flexible cables.

Tin and Its Uses.—The third number of the International Tin Research and Development Council's new quarterly review, *Tin and Its Uses*, contains accounts of the Council's Bureau

of Technical Information, and of the free technical service offered to tin consumers. It is explained how these services may be utilised by firms who, under war conditions, are operating for the first time processes involving tin, and some examples are given of the difficulties encountered in the application of tin in various industries, and of the methods recommended to overcome them.

There is an account of a method of polishing soft metals by electrolysis for microscopical examination which has important advantages over mechanical polishing, and it is claimed that the method produces surfaces of very high reflectivity.

Another article states that tomato products may absorb copper from equipment of copper or brass and that to replace such equipment by stainless alloys would be extremely expensive, but copper and brass may be rendered safe for any food at small cost by applying a coating of tin, by either hot dipping or electro-tinning. The latter method produces thick, serviceable coatings, but the Council is able to give advice on either process.

Other subjects dealt with in this issue include the adoption of tinned pistons in the motor industry to avoid troubles during running-in, and tests on the nutritive values of canned foods and on the causes and control of hydrogen swells in canned fruits.

An interesting recent development in the use of tin-plates consists in applying a highly decorative surface of another metal, such as copper, nickel or chromium, to produce what are known as "pre-finished" sheets which can be formed into a great variety of useful articles without requiring expensive plating and polishing operations after fabrication.

Jute Research.—An extension of the *Technological Research Laboratories* at Tollygunge for experiments on weaving and spinning fine yarns from jute and yarns from jutes blended with other fibres, such as flax, is under consideration of the *Indian Central Jute Committee*.

It is estimated that at present about 80 per cent. of the jute produced is used for making hessians, sackings and similar heavy cloths. There are big potential world outlets for the fibre in the production of clothing materials, furnishing materials for curtains, carpets, upholstery, etc., and the finer types of canvas.

Although much has been done in Europe and America, further research is necessary into the problems involved in the production of the finer qualities of jute cloths. Some of the difficulties are well known. For example when jute yarns are bleached, as is normally necessary in making clothing materials, there is a great loss in strength, which is particularly noticeable when the yarn is wet. This makes for poor resistance to laundering. Blending with flax, or doubling the jute yarn with a flax or cotton yarn may overcome the difficulties, but other possibilities are open for investigation.

Breeding of new varieties of jute yielding the finest and most suitable type of fibre offers considerable promise. Conditions of growth and retting and their influence on the type of fibre obtained also require further investigation.

Announcements

Lucknow University.—Faculty of Sciences, Special Lectures. Session 1939-40:—

January 10 and 11: Dr. A. C. Chatterji, D.Sc., "Stability of Colloids". January 12, 13 and 14: Prof. N. N. Sen Gupta, M.A., Ph.D., F.R.S., "The vicissitudes of the mind; (i) The course of mental growth; (ii) The profiles of the mind; (iii) Disintegration and decay of the mental personality". January 16 and 17: Mr. Boshi Sen, B.Sc., "Vernalisation". January 24 and 25: Dr. R. S. Verma, D.Sc., "Whittaker functions and wave mechanics". January 29, 30 and 31: Dr. S. Hasan Zaheer, B.A., Ph.D., M.L.A., "Sterols and related compounds". February 2 and 3: Mr. Kali Prasad, M.A., LL.B., "Planes of intelligence: (i) Criteria and the technique; (ii) Data and their interpretation". February 5 and 6: Dr. Makund Behari Lal, D.Sc., "Helminthology: (i) Host-specificity as applied to Helminths; (ii) Recent additions to our knowledge of Avian Trematodes". February 8, 9, 10 and 11: Dr. A. N. Singh, D.Sc., "Some modern theories of integration". February 15, 16 and 17: Prof. A. C. Banerji, I.E.S., "Galactic dynamics: (i) Formation of arms of a spiral nebula, (ii) Polytropic gaseous configurations; (iii) The origin of planets and satellites". February 19 and 20: Mr. S. B. L. Mathur, M.Sc., "Cosmic Rays and subatomic particles". February 25, 26 and 27: Dr. A. B. Misra, D.Sc., "Reproduction in Indian birds".

Training in Librarianship.—Class for training will be held at the Imperial Library, Calcutta. The session will commence on March 1 and last for about six months. Admission will be restricted to 20, but will be open to applicants from all over India, including Indian States, preference being given to those already working in libraries. The minimum qualification for admission is a university degree, but those working in libraries will be required to have passed at least the Intermediate Arts examination. No application will be considered if received after January 30, 1940.

Provision has been made for training in classification, cataloguing, book selection, reference work, library routine and organisation, bibliography and library hand-writing. Diplomas will be awarded on the results of an examination at the end of the course.

The fee for the entire course will be Rs. 75 payable in advance.

The International Institute of Agriculture announces that a publication entitled "A new study of World Production and Trade in Oils and Fats" in two volumes has been recently issued. The first volume deals with vegetable oils and fats; the second with butter, pig and beef fats, marine animal fats, the consumption of oils and fats in the chief importing countries on the world market, the utilization of oils and fats, and the movement of prices. (Price 25 lire for each volume.)

The two volumes appear as Nos. 4 and 5 of the series of publications on the "Principal Agricultural Products on the World Market",

Messrs. G. Bell & Sons announce that the Tercentenary Memorial Volume on James Gregory, containing his correspondence with John Collins and his hitherto unpublished mathematical manuscripts, together with addresses and essays communicated to the Royal Society of Edinburgh, has been recently published. The volume is edited by Prof. Herbert Westren Turnbull, F.R.S., and has been published for the Royal Society of Edinburgh. (Price 25sh. net.)

We acknowledge with thanks receipt of the following:—

"Journal of Agricultural Research," Vol. 59, Nos. 4-5.

"Agricultural Gazette of New South Wales," Vol. 50, Pt. 11.

"The Philippine Agriculturist," Vol. 28, No. 6.

"Biochemical Journal," Vol. 33, No. 9.

"Journal of Chemical Physics," Vol. 7, Nos. 10-11.

"Journal of the Indian Chemical Society," Vol. 16, No. 9.

"Journal de chimie physique," Vol. 36, No. 6.

"Chemical Products," Vol. 2, No. 6.
"Comptes Rendus (DOKLADY)," Vol. 24, No. 5.
"Experiment Station Record," Vol. 81, No. 4.
"Indian Forester," Vol. 65, No. 12.
"Transactions of the Faraday Society," Vol. 35, Nos. 222-223.
"Review of Applied Mycology," Vol. 18, No. 10.
"Nature," Vol. 144, Nos. 3647-3653.
"American Museum of Natural History," Vol. 44, Nos. 3-4.
"Occasional Notes" (Royal Astronomical Society), No. 6 (October 1939).
"Canadian Journal of Research," Vol. 17, Nos. 9-10.
"Journal of the Royal Society of Arts," Vol. 87, Nos. 4533-38.
"Journal of Research," National Bureau of Standards, Vol. 22, Nos. 5-6 and Vol. 23, No. 1.
"Sky," Vol. 3, No. 12 and Vol. 4, No. 1.
"The Lingnan Science Journal," Vol. 18, No. 4.
"Science Progress," Vol. 34, No. 134.
"Indian Trade Journal," Vol. 135, Nos. 1742-46.

ACADEMIES AND SOCIETIES

Indian Academy of Sciences

November 1939. SECTION A.—SIR C. V. RAMAN AND V. S. RAJAGOPALAN: *Haidinger's rings in soap bubbles*. Soap bubbles suitably maintained to have a perfectly uniform thickness exhibit by transmission or reflection interference figures consisting of concentric rings which are essentially of the same physical nature as the Haidinger rings due to a plane-parallel plate. H. J. BHABHA: *Classical theory of electrons*. B. D. SAKSENA: *The complete Raman spectrum of glycerine*. 21 Raman lines (some of them new) and an O-H band have been recorded: 12 of these are polarised and 3 depolarised. On dilution with water, the line 674 becomes more diffuse, and increases in frequency by 15 cm.⁻¹ at 25% dilution. T. VIJAYARAGHAVAN: *On the irrationality of a certain decimal*. F. C. AULUCK: *On Poncelot polygons*. J. A. NABAR, P. M. BARVE, A. M. PATEL AND B. N. DESAI: *Adsorption of naphthols in the presence of different electrolytes and peptising agents and at different temperatures*. The adsorption on cotton fibre has been measured, under various conditions to understand the mechanism of the process of dyeing. B. K. SINGH AND B. BHADURI: *Studies on the dependence of optical rotatory power on chemical constitution—Part XVI. Bromo-, and Iodo-, Aryl derivatives of stereoisomeric methylenecamphors*. V. T. CHILPUNKAR: *Rectification in discharge tubes*. A quantitative study is made of the rectification as a function of the pressure in the discharge tube, disposition of the electrodes, etc. S. S. PILLAI: *On the smallest prime of the form km + 1*. S. S. PILLAI: *On the number of representations of a number as the sum*

of the square of a prime and a squarefree integer. S. S. PILLAI: *On numbers which are not multiples of any other in the set*. R. S. KRISHNAN: *Scattering of polarised light in colloids*. The depolarisation of light scattered in the transverse horizontal direction when the incident beam is inclined at an angle θ to the vertical, has been studied. The calculated relationship does not strictly hold for particles of any size and shape; the deviations are however not large and may be due to a second order effect. D. N. MOGHE: *On the stability of equilibrium of an isolated fluid sphere*. D. N. MOGHE: *On some non-static solutions of Einstein's gravitational equations, and fluid spheres with the pressure and density as slowly varying functions of time*. S. SIDDIQUI AND V. SHARMA: *Studies in the conessine series—Part V. Reduction of nitro-conessine to conessine-oxime and conversion of the oxime to mono-oxy-conessine*.

November 1939. SECTION B.—S. A. AKHTAR: *On some nematode parasites from Afghanistan*.

Indian Association for the Cultivation of Science (Proceedings):

August 1939.—DEBESHCHANDRA ROY: *New measurements of aluminium monoxide bands*. M. V. SIVARAMAKRISHNAN: *A simple method of coating optical surfaces with aluminium*. S. A. AZIZ: *Raman spectrum of diphenyl in the solid state*. J. N. BHAR: *Studies of the ionosphere at Calcutta*. MOHINIMOHAN GHOSH: *Dynamics of the pianoforte string and the hammer—Part III (General Theory)*. L. SIBATTA AND M. RAMA RAO: *Surface tension and Lindemann Frequency*. L. D. MAHAJAN: *Liquid drops*.

Indian Chemical Society:

September 1939.—SHARIFUDDIN WARSI AND SALIMUZZAMAN SIDDIQUI: The constituents of *Didymocarpus Pedicellata*—Part III. Isolation of a sesquiterpene and two polyterpene products and examination of the fatty matter. K. P. BASU AND M. C. MALAKAR: Calorific values of Indian foodstuffs. PANCHANAN NEOGI AND KANAI LAL MANDOL: Co-ordinated copper compounds with propylenediamine. N. L. VIDYARTHI AND C. J. DASA RAO: Fatty acids and glycerides of the fat from the seeds of *Garcinia Indica* (kokum butter). N. L. VIDYARTHI AND M. VENKATESH MALLA: Fatty acids and glycerides of the oil from *Sapota* seeds (*Achras Sapota*). K. P. BASU AND K. GUPTA: The role of vitamins and calcium in the diet in the utilisation of proteins. PHULDEO SAHAY VARMA, N. B. PAREKH AND V. K. SUBRAMANIAM: Halogenation—Part XXI. Direct replacement of aromatic sulphonic groups by chlorine and bromine atoms. N. R. DHAR AND E. V. SESHACHARYULU: New aspects of nitrogen fixation and conservation in the soil—Part III. Influence of light on bacterial numbers and nitrogen fixation. PHULDEO SAHAY VARMA AND (MISS) K. M. YASHODA: A note on the iodination of a few halogenated phenols. N. L. VIDYARTHI AND M. VENKATESH MALLA: A note on the occurrence of an isomer of ricinoleic acid in the fatty oil from the seeds of *Vernonia Anthelmentica*.

Indian Botanical Society:

September 1939.—SAYEEDUDDIN, M., AND MOINUDDIN, M.: Anatomical study of *Holmskioldia sanguinea* Retz. (*Verbenaceae*). KRISHNA IYENGAR, C. V.: Development of embryo-sac and endosperm-haustoria in some members of *scrophularineae*—III. *Limnophila heterophylla* Benth. and *Stemodia viscosa*, Roxb. FOTIDAR, A. N.: The primary vascular system of the stem of *Nyctanthes arborescens* L. SULTAN AHMAD: Higher fungi of the Punjab plains—I. The

Gasteromycetaceae. FOTIDAR, A. N.: An example of a naked ovule in *Galphimia gracilis*. PARIJA, P. AND SAMANTARAI, E.: March of transpiration of a leaf since its measurable stage to its fall. SÂNE, Y. K.: A contribution to the embryology of the *Aponogetonaceae*.

The Geological, Mining and Metallurgical Society of India:

The recent numbers (Vol. XI, Nos. 1 and 2) of the quarterly journal of the above Society contain several papers of geological and metallurgical interest. Of these the following may be mentioned: *Geology of the area around Phonda and parts of Bavda Jahgir* (Ratnagiri Dt., Bombay) by R. D. GODBOLE, and *Geology and petrology of the iron ore deposits of Mandi State, Punjab*, by S. K. ROY AND A.N. MUKHERJEE. A paper by D. SWARUP AND T. V. N. KIDAO records certain valuable observations on the "Heat treatment of high carbon stainless steels".

The Society has also recently published a Bulletin on "The uses and applications of sheet and waste mica" by the well-known mica specialist Ramani Ranjan Chowdhury, in which quite a lot of useful information has been condensed, which is sure to be of great value to those interested in the development of the mica industry in India.

Meteorological Office Colloquium, Poona:

October 12, 1939.—A. K. MALLIK: Sorption with special reference to the exchange of moisture between the air layers near the ground and soil and plant materials.

October 19, 1939.—DR. N. K. SUR: A discussion of some sounding balloon ascents during a depression in July 1937.

October 27.—C. RAMASWAMY: Petterssen's paper on some aspects of formation and dissipation of fog.

Errata

1. Vol. 8, No. 10, October 1939, page 470:—

Column 1, last line of the first paragraph: for "Kamai Lal Mandal" read "Kanai Lal Mandal".

2. Vol. 8, No. 11, November 1939, page 512:—

Note entitled "Condensation of Chalkones with Flavanones":

Column 1, line 4, for $\text{Ph}\cdot\text{CO}\cdot\text{CH}=\text{CO}\cdot\text{Ph}$ read $\text{Ph}\cdot\text{CO}\cdot\text{CH}=\text{CH}\cdot\text{Ph}$.

Column 2, line 1, for "pulverisodium" read "pulverised sodium".

Column 2, line 2, for "the last two being" read "the last two reagents being".

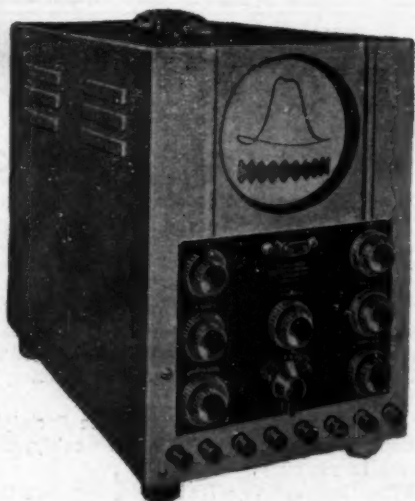
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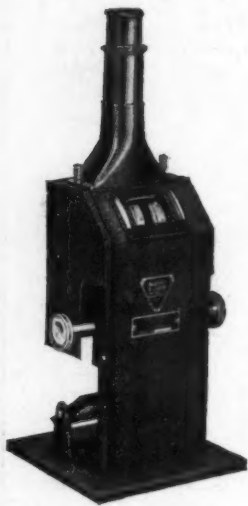
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